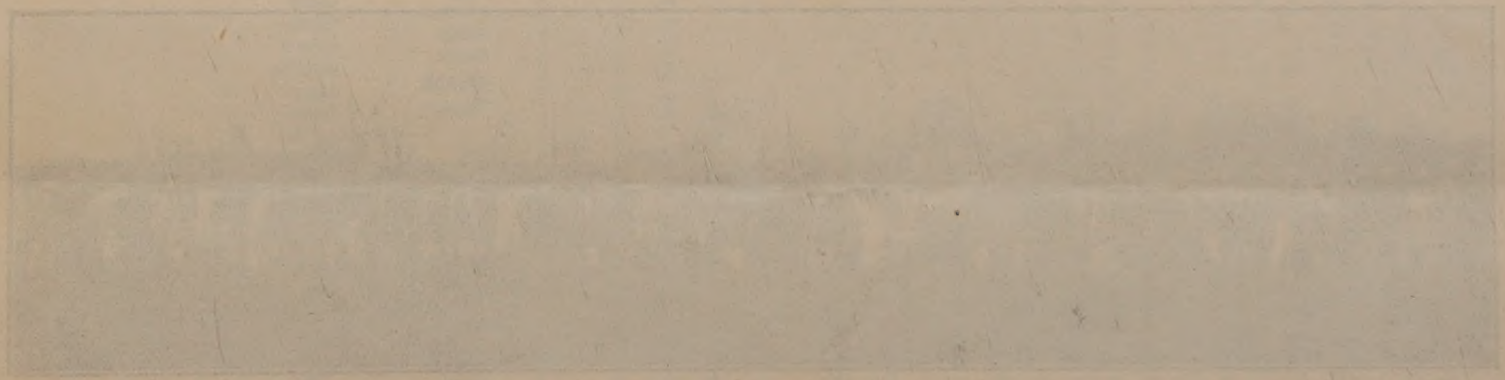

PLATE I

THE MYSORE AGRICULTURAL AND EXPERIMENTAL UNION.

THE FIFTH ANNUAL MEETING—FIELD DAY ON THE HEBBAL FARM.

NEVER BEFORE DID THE HEBBAL FARM WELCOME SO LARGE A NUMBER OF MYSORE AGRICULTURISTS. THE PICTURE SHOWS ONLY A FEW BATCHES OF OUR MEMBERS STUDYING THE VARIETAL CHARACTERS OF SUGARCANE.

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The Defects in Silk-worm Rearing in the State and some Suggestions to overcome them.

BY

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Silk Expert in Mysore.

The most important factor in the sericultural industry is the production of cocoons. This depends mainly upon the way of rearing the silk-worms. If the method of rearing is bad, generally the worms become weak, puny and liable to diseases, as a result of which the crop cannot be expected to be good. It is usually reduced to $\frac{2}{3}$ or $\frac{1}{2}$ and it may even happen that the rearer gets nothing at all, and has to throw away all the worms. In addition to these difficulties the worms mounted after such rearings usually spin cocoons far inferior to those spun by the worms reared perfectly. Besides many worms will die on the *chandrikes* before spinning and many die inside the cocoons after spinning. The dead worms will spoil the good cocoons ; especially the cocoons with dead worms inside spoil the other cocoons in the course of harvesting, weighing, packing and transporting, etc., thus greatly increasing the proportion of inferior cocoons. The result is not only a loss to the rearer but also to the reeler as the latter has to spend more to get less quantity of inferior silk.

An average yield of 30 lbs. of green cocoons for 100 layings of eggs is considered satisfactory by the raiyat in Mysore. Of course he gets less than this frequently, and occasionally, that is to say once in every two or three times, he loses the entire crop. I have known raiyats complaining that they only get every alternate crop. Should a raiyat be satisfied with a yield of 30 lbs. for 100 layings for good crops, and reconcile himself to frequent, nay even to successive, failures ?

In fixing a standard, we must consider the nature of the Mysore silk-worm, and from my experiments and experience, I find that 100 layings of this worm, after allowing for a loss of 20 per cent in the course of rearing ought to yield about 25,000 cocoons weighing about 45 or 50 lbs. This is the average. The maximum would be somewhere about 70 lbs. *These results are based not on arithmetical calculations but on actual and repeated experience.* It is within the power of every raiyat to get 45 or 50 lbs. for 100 layings on the average, instead of 30 lbs. which is considered satisfactory now, and to get this, he has only to rectify some of the faults in his methods of rearing. These faults can be easily rectified, and I shall proceed to describe them and suggest right methods.

The first thing that strikes one at the sight of the rearing of the raiyat is the overcrowding of the worms in a tray. The space given by the rearer for the worms of 100 layings is about $\frac{1}{4}$ to $\frac{1}{3}$ square foot at the time of brushing, 2 to 3 square feet at the end of first age, 5 to 6 square feet at the end of 2nd age, 10 to 12 square feet at the end of 3rd age, 24 to 30 square feet at the end of fourth age and 40 to 60 square feet at the time of mounting in most cases. This is an extremely small amount of space for the worms in the different ages. Let us compare this with the practice in other countries. In Japan the brushed worms of 28 layings are given 1 square foot at the time of brushing, 6 square feet at the end of first age, 12 square feet at the end of 2nd age, 30 square feet at the end of 3rd age, 60 square feet at the end of 4th age and 90 square feet in the 5th age. In Italy and France the rearers are giving almost the same space in the different ages though they brush slightly closer as the eggs are in a free condition.

Looking at the tray of a raiyat who has newly brushed worms one will find something like a sheet of black velvet or chimney soot

spread on it. This mass consists of thousands and thousands of silk-worms that are unfortunately treated almost as inanimate things in spite of their having individual life, simply because of their tiny sizes. Yet they have strong vitality and a vigorous capacity for growth so that they are able to increase to two or three times in a day and to reach 14 or 15 times their weight at the end of the 1st age. For this wonderful capacity to have full scope, the worms must be given space and food and the failure to give these is the first great fault of the Mysore raiyat.

The worms are kept in a little space, and a small quantity of food quite covers them ; so that one sees the shredded leaves quite covered with thousands of hungry worms immmediately after each feeding. This defect directly prevents the silk-worms from making perfect development and rapid progress. This is one of the chief reasons why the cocoon produced by the rearer is always poorer than it ought to be and also his rearing takes so long. This error begins with the brushing and persists throughout the rearing, till they mount. Generally the treatment is worst in the younger age ; because with the advancement of the age, the individual body of the worm becomes distinct and one can observe the state and the movements of the worms easily as a result of which the rearer will begin to feel some interest in them ; but the worms that are once spoiled in the younger age have almost no prospect of recovering. Though the Mysore worm is by nature strong, this cruelty makes it weak, and liable to disease ; many worms die in the course of the rearing, and those which survive spin poor cocoons.

The proper treatment only requires a little knowledge and care, and does not cost much. Closely connected with the defect in spacing is the great defect in the way of feeding. In feeding the worms the most important points are the quantity of food given at one time and the number of feedings given in a day. The former depends to some extent on the amount of space given to the worms ; as the space given by the rearers is too narrow, so the quantity of leaves fed is always too little. The points to keep in mind are these : the leaves must be in good condition for silk-worm food. There must be enough for each worm. There must not be too much, for the excess dries up and becomes unfit for food and is therefore wasted. Directly one feeding is eaten up another should be given. In short

the feeding should be so regulated that the worms should get enough fresh leaves whenever they want to eat. It is a calamitous mistake to think that if you give a large quantity once for all you can dispense with frequent feedings. Silk-worms must eat at very short intervals throughout the day and cannot consume sufficient quantity at one time to be able to store up enough nourishment for several hours.

Another very bad feature of the raiyats' rearing is that so many diseased worms are allowed to remain in the tray with healthy ones. It is easy to understand that in a rearing which has the two defects noticed above — overcrowding and insufficient food — there are many diseased worms but why are they not picked out and thrown away ? They are of no possible use and in due course the healthy worms also contract the disease and losses result.

I must here mention one more cause of insufficient nutrition and disease, namely, bad quality or bad condition or unsuitable nature of leaves. The worms do not eat such leaves unless driven by extreme hunger, and they sicken and die. Dusty or wet leaves, or leaves which are too tender or too ripe for the age of the worm, are of this class.

In the course of rearing, the worms require the greatest care during the time of moulting. If the climate at that time is quite suitable and the rearing is all right the worms will generally go to moult uniformly without any particular trouble ; but with indifferent rearing and unsuitable weather conditions, the worms will often go to moult quite ununiformly causing great confusion to the rearer. The rearer will not know whether to stop the feeding as some worms will still be eating in spite of the majority being under moult. In the meantime some advanced worms will come out of moult before the late worms go to moult, so that it may happen that in the same tray there are worms which have not gone into moult, worms in moult, and worms which have come out of moult. The rearer feels hopelessly puzzled. The same trouble may occur either at the time of the worms going into moult, or coming out of moult. The matter requires quick decision and common sense, but a few directions based on experience may be useful.

(i) Never give feeding to worms which are not in moult in the same tray where there are many worms in moult.

(ii) If the worms which have not yet gone to moult are a very small part of the whole, and all the others have gone into moult, neglect those which have not gone into moult, and stop feeding.

(iii) If a very large number of worms have not yet gone into moult, and you cannot afford to reject them, separate them from the tray by means of using a thin layer of husk and a net, and a thin feed. Then keep them in a different tray in a warm place and feed them up carefully, to hasten their progress.

(iv) In case of coming out of moult also, if only a few worms remain in moult they may be neglected, and feeding given. If a large number still remain behind, the small number which have come out of moult may wait for feeding till the others come out. If a very large number come out they should be separated.

(v) In all cases, the late worms should be given special care in food and warmth to make their growth more rapid, so that they may catch up the other worms.

To rear silk-worm perfectly it is quite essential to pay attention to the season for the rearing. However good the seed, excellent and plenty the supply of leaves, and skilful the treatment may be, still if the season for the rearing is not proper, one cannot expect any satisfactory result. There are often certain seasons quite unsuited for conducting rearings; among them extremely hot and very damp seasons are the worst and they should be avoided. Especially when weather conditions are both hot and damp it is quite hopeless to rear successfully. When such seasons can be anticipated one should never attempt to have a rearing. He should reserve his resources for a more suitable season. In short the suitability of the season is of such supreme importance that even among suitable seasons one should make a further study and select the best for putting out his utmost effort and resources.

Obviously disease-free eggs are necessary for a good crop but a disease-free rearing room is also equally necessary. Hence the raiyat should never forget to disinfect his rearing chamber and appliances, etc. Of course by using the disease-free layings he can escape from the havocs of the disease that will come through the mother. But that has no connection with the disease that would come either through the mouth or any other way of contagion while feeding.

These can be prevented mainly by disinfection. Especially, if a crop should have been lost through disease, disinfection is quite necessary. For disinfection, the rearer has to spend something which is however not a very heavy tax on him. Even if he does not carry out the disinfection during each rearing, he ought at least to do so once after every third or fourth rearing,, according to his ability. But he should not neglect to keep the rearing room and the appliances always clean. He should very often expose the rearing appliances to the sun soon after each rearing and before commencing another. In addition to these he should wash all the articles, stands and the room well before and after every rearing. This is also one of the ways of getting rid of the source of disease. Exposing the articles to the sun is a specially effective means of disinfection. One easy way of disinfecting is to burn sulphur in the rearing room, so that the room gets full of fumes. As the fumes take time to kill the germs of disease, care must be taken to stop up all cracks and openings by pasting paper, so as to keep the sulphur fumes in as long as possible. But the safest thing to do is to wash appliances well with clean water and dry them in the sun.

Finally I want to give some instructions to the rearer in the mounting of worms and harvesting of cocoons. To begin with, in mounting, the rearers in the State generally place far more worms in a *chandrike* than there is room for them. The only suitable place for the worm to spin the cocoon in a *chandrike* is the angle at the bottom of the circular strip inserted inside. The interspace between the strips is too broad for the silk worms to stretch the silk filaments which they have to do before building the cocoon and hence they do not serve the purpose at all. The worms are therefore compelled to gather in the corners mentioned above ; moreover the number of worms allowed in one square foot reaches to about 300 to 400 in most cases and all these not having convenient space, build over one another wasting their silk, and producing all sorts of deformed and abnormal cocoons. The colour and lustre and reelable nature of the cocoons are all damaged. In addition to this there are also very many diseased worms in the cocoonage as a result of the bad rearing and negligence to pick out diseased worms. The exudations from these ruin many cocoons around them either before or after spinning.

Moreover the dead worms found after spinning are never separated from the good cocoons at the harvest or sale. Hence in the processes of weighing, packing, transmitting, stifling, drying, preserving the cocoons, etc., the bad cocoons are staining the good cocoons around them. It need hardly be said that cocoons with dead pupæ, thin-layered, stained, flattened and irregular shaped cocoons are all far less in value in the reeling. If these are mixed with good cocoons and cooked together while reeling, the cooking will be quite ununiform and much trouble is caused in taking out the thread ends thus involving a heavy labour in reeling. After great trouble in the basin, and spoiling the quality of the silk these cocoons come out as waste.

The only remedy is that the rearer should either decrease the number of worms allowed in the *chandrike* or increase the suitable place for spinning by putting the circular strip (the *phool* or the *huvu* or the flower as it is called) closer together. In old *chandrikes*, twigs or straw or weeds might be disposed in the interspaces to furnish corners in which the worms can conveniently stretch their filaments and spin good cocoons. The fault caused by negligence in separating the stained and dead cocoons can be avoided without any extra labour, simply with the little care of keeping the inferior cocoons mostly stained, apart from the good cocoons.

The rearers mix good cocoons with bad to avoid losing weight and because the reelers tolerate this mixing. Neither the rearers nor the reelers would do it if they knew what was good for themselves. It is a very short-sighted policy to spoil the good name of the silk of Mysore in this way, and in the result neither the rearer nor the reeler gains any real profit by the bad practice.

Another great mistake committed by the rearer is to remove all the cocoons too early from the *chandrikes*. The rearer exposes the mounting worms to sunlight so as to make the worms spin the cocoons early and then removes the cocoons after only a day, while many of the silk worms at that time inside the cocoons are before pupation and even the earliest worms are just finishing pupation. So the cocoons handled at such a time are spoiling the innermost layers of the cocoons as the pupæ just transformed from the worms are very soft and delicate and are liable to be crushed even at the least rough treatment and thus stain the inner layings with the blood.

The layers that are stained with the blood become unsuitable for reeling and cause great trouble even though they are reeled with great patience. This again is due to a desire to get as much weight as possible, even though there is real loss both to the rearer and reeler and to the country. The purchasers of the cocoon should be careful and they would act better to reduce the price for such cocoons and pay more for the cocoons that have been allowed to remain in the *chandrikes* till perfect pupation.

Red Soils and their Manurial Requirements.

BY

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The type of soil on which ragi (*Eleusine coracana*) is most extensively grown in the State is the red one. It is the prevailing type in the districts of Bangalore, Kolar, Mysore and Tumkur and generally overlies the granite from which it is derived from a few inches to several feet.

What is usually called a loam is generally the predominant type from a physical stand-point of view. The few samples which have been analysed in this laboratory have shown the following mechanical composition :—

Clay varying from		7 to 10 per cent.
Silt	,,	10.7 to 13.4 per cent.
Sand	,,	70.4 to 58.3 per cent.
Gravel	,,	7.5 to 14.6 per cent.

The water-holding capacity of these soils is not very high. On an average they are capable of taking up about 21 per cent of their own weight of water. The optimum water-content for the production of good crops lies between 60 and 70 per cent of the water-holding capacity. When so saturated, the soil contains 12 to 14 per cent of water, calculated on its dry weight. During the growing season the amount of water in a soil should not go below 40 per cent of its water-holding capacity ; that means, when the soil contains only about 8.5 per cent of its own weight of water, it is very difficult for the plants to obtain the water they require. Even when the soil contains as much as 12 to 14 per cent of water, the

total quantity of it is not sufficient for the requirements of the crop even for a couple of days. In fact, the amount of water lost daily through transpiration and evaporation will have to be renewed constantly. Generally, during the growing season, the soil contains more than 14 per cent of water and the daily loss is recouped by the supply of water from below and the showers of rain that fall during the season. It is only when the store of moisture has been pumped out to the lower limit of 8 or 9 per cent and there is no rain at the right time that the plants begin to suffer from drought.

Almost all the ragi soils bake into a brick-like consistency when they dry out and the raiyat finds it very hard to keep the surface loose and friable with the implements at his disposal at present.

Soon after harvest, the fields contain very rarely more than 5 per cent of moisture in the top 6 inches and it is very difficult to plough them up in that condition. When left untouched till the next cultivating season, the soil dries out very rapidly and in February there is not more than 2 per cent moisture in the top 6 inches. Even the sub-soil down to a depth of 2 feet does not contain more than 12 per cent moisture. On the other hand, if the fields could be ploughed up soon after harvest taking advantage of some stray showers, the ploughed surface of such a field contains about 5 per cent moisture in the top 6 inches against 2 per cent in the unploughed one. Even the sub-soil down to a depth of 2 feet contains between 15 and 17 per cent moisture against 12 per cent in the unploughed one. Thus, the mulch of loose earth on the surface of the ploughed field prevents the sub-soil from getting too dry. The amount of water so retained is certainly not sufficient for the requirements of plants, but may be quite beneficial for the bacterial activity in the soil, a point which still needs to be investigated specially with regard to nitrogen-fixation and nitrification. The loose surface on the ploughed fields acts advantageously in another way. On account of its porous nature much of the water from the first good shower of rain is absorbed whereas most of it runs to waste on an unploughed field. Part at least of the water so absorbed might get into the sub-soil and help to further the bacterial activities there. The actual benefit to the soil and the crop subsequently grown on it has already been discussed elsewhere. See "The Cultivation of Ragi in Mysore" by L. C. Coleman, M.A., Ph. D., Director of Agriculture in Mysore.

The following table gives the chemical composition of some of the Mysore soils analysed in the Laboratory of the Department of Agriculture.

Register No.	Description	Insol Residue per cent	Oxides of Iron and Alumina per cent	Lime CaO per cent	Magnesia MgO per cent	Nitrogen N per cent	Phosphoric acid P_2O_5 per cent	Potash K_2O per cent	Loss on Ignition per cent	Moisture per cent
1	2	3	4	5	6	7	8	9	10	11
583	Shallow red soil from Alanhalli at the foot of Chamundi Hill ..	91.01	5.67	0.25	0.19	.033	Trace	....	1.79	0.87
584	Do ..	84.55	8.22	0.62	0.47	.05	Do	....	3.51	2.16
585	Do ..	91.09	5.27	0.47	0.27	.039	Do	....	2.21	0.59
593	Soil from Mugur in T. Narsipur Taluk ..	92 45	3.99	0.19	0.24	.028	.051	....	1.45	1.48
594	Do ..	81.31	7.77	0.37	0.47	.052	.025	....	3.32	3.60
595	Soil from Mugur in T. Narsipur Taluk (from bed of an old tank) ..	54.14	22.44	1.36	1.43	.043	.090	....	8.34	11.27
597	Soil from Yelandur ..	82.00	9.27	0.37	....	.043	.080	....	3.63	3.68
81	Soil from Hebbal, Bangalore Taluk ..	90.06	6.47	0.12	....	.039	.027	....	2.18	0.70
624	Soil from Babbur Village, Hiriyur ..	79.62	10.72	0.65	0.91	.047	Trace	....	4.35	3.52
625	Do ..	78.12	11.37	1.20	1.04	.035	Do	....	4.28	3.77
626	Do ..	82.18	9.77	0.85	0.79	.040	Do	....	3.43	2.68
629	Soil from Bangalore Military Dairy Farm ..	88.41	6.17	0.19	0.27	.081	.083	.137	4.97	....
1559	Soil from Kunigal Stud Farm ..	79.13	....	.41	....	.094	.20	.47	....	....
1560	Do ..	79.05	....	.50	....	.106	15	.33	....	....
1561	Do ..	85.48	....	.30	....	.071	.047	.24	....	....
1562	Do ..	86.26	....	.21	....	.070	.190	.23	....	....

It is seen from the table that the nitrogen content of the soils varies from .028 per cent to .081 per cent. It is not known how much of this low percentage of total nitrogen is available to crops during the growing season. The major part of it must undoubtedly have been derived from the cattle manure put into the soil now and then. In the usual system of manure making, much care is not bestowed on the collection and preservation of the urine of cattle ; so, the greater part of the nitrogen in the manure itself comes from the dung collected. It has been established by investigations in Europe that the nitrogen of the dung is of very slow availability. How this low nitrogen content varies when the fields are being prepared for the crop still remains to be investigated in this country. The occasional showers of rain and the frequent ploughings and cultivations following it, might have a beneficial effect on the bacterial activity specially with regard to nitrogen-fixation. Nitrogen being the costliest of all manures and one that gets easily leached out, anything that contributes to increase the store of nitrogen in our soils is sure to benefit the crops as well.

Coming now to the phosphoric acid content of the soils, it will be seen from the table that it varies from a trace to ·09 per cent.

The amount of potash has unfortunately not been determined in all the samples and so nothing definite can be said about the richness of it or otherwise.

The last four samples whose analyses are included in the table are not from ragi fields, but from grass land fit for ragi cultivation. They show not only a greater uniformity in composition but are also relatively richer in plant foods. The nutrition of the ragi plant itself has still to be studied. What is known and has been investigated about the ragi soils too, is not much. Except the fact that the soils are rich in oxides of iron and aluminium and poor in nitrogen, phosphoric acid and lime, nothing else is known. A regular soil survey combined with manurial experiments can alone throw much light on the manurial questions connected with ragi.

To get a preliminary idea as to what extent such red soils would respond to various nitrogenous and phosphatic manures, pot experiments are being conducted since 1920.

The nitrogenous manures experimented with are nitrate of soda, sulphate of ammonia, groundnut cake, honge cake and castor cake.

Each treatment has always been repeated in 4 different pots to eliminate the experimental error as far as possible and the average yields from four such similarly treated pots are given in the tables that follow. The experiments have been conducted with reference to the crops usually grown on red soils, ragi and jola, which form two of the staple crops of our State.

The results of experiments conducted in 1920 to see how far various nitrogenous manures are utilized by ragi when grown in a red soil are given in the following table :—

Weight of total dry matter produced, in grams.

	Nitrate of Soda	Sulphate of ammonia	G. nut cake	Honge cake	Castor cake
No manure	50·1 26·2	141·4 26·2	108·5 26·2	92·1 26·2	130·1 26·2
Increase due to nitrogen	23·9	115·2	82·3	65·9	103·9
	Weight of grain produced, in grams.				
No manure	16·8 7·4	41·5 7·4	32·5 7·4	27·4 7·4	38·0 7·4
Increase due to nitrogen	9·4	34·4	25·1	20·0	30·6

From the above figures it will be seen that the increase in yield, both with regard to grain as well as total dry matter produced, has been the highest in the case of sulphate of ammonia and least in the case of nitrate of soda. Of the oil-cakes, caster cake has shown itself the best and groundnut and honge come next to it in order.

The results of experiments with jola conducted in 1921 are given in the following table :—

Weight of total dry matter produced, in grams.

	Nitrate of Soda	Sulphate of ammonia	G. nut cake	Honge cake	Castor cake
No manure	6·4 4·8	25·1 4·8	24·4 4·8	27·3 4·8	47·3 4·8
Increase due to nitrogen	1·6	20·3	19·6	22·5	42·5

PLATE II.

112 Groundnut cake only.
134 Groundnut cake and super.
116 Kurdi cake only.

140 Kurdi cake and super.
118 Castor cake only.
142 Castor cake and super.

The maximum amount of crop produced in this series is only 47 grams, whereas it was 141 grams or 3 times as much in the case of ragi. The soil used in 1921 was not the same as that used for ragi experiments in 1920. Whether the difference in yields produced is due to the soil or the crop is being investigated by growing the two crops in the same soil and under similar conditions. Even here it is seen that sulphate of ammonia has acted better than nitrate of soda and that castor cake is the best of the three kinds of cake tried. That the two kinds of soil used are deficient in nitrogen and that they respond to nitrogenous manures is clearly indicated from the results tabulated above.

It has already been stated that chemical analysis of red soils has indicated that they are deficient, at any rate not rich, in phosphoric acid as well. To find out how far response to phosphatic manuring can be expected, a new series of experiments was started in 1921 using superphosphate along with various sources of nitrogen. Superphosphate was selected because from the results of another series of experiments in which super, basic slag and bone-meal were tried, it was found to be the most available source of phosphorus.

The results of the series of experiments with superphosphate along with various sources of nitrogen using jola as the experimental crop are given in the following table :—

Weight of total dry matter produced, in grams.

	No Nitrogen	Nitrate of Soda	Sulphate of ammonia	G. nut cake	Honge cake	Castor cake
With super.	8·6	88·3	98·1	79·6	74·7	76·1
No super ..	4·8	6·4	25·1	24·4	27·3	47·3
Increase due to super ..	3·8	81·9	73·0	55·2	47·4	28·8

These results show that the addition of superphosphate has increased the yield considerably and a combination of sulphate of ammonia and superphosphate seems to be the best. The increase in yield due to the addition of superphosphate is more in the case of nitrate of soda than in the case of sulphate of ammonia, but this

seems to be enhanced by the fact that nitrate of soda alone gave a very low yield.

The differences in growth due to the addition of superphosphate to oil-cakes used for experiments with jola are clearly shown in the photograph reproduced in plate II.

These experiments have brought out the fact that both nitrogenous and phosphatic manures are needed to increase production on the types of red soils experimented with. Experiments with regard to potash and lime requirements have not yielded any clear indications as yet. Making use of the indications obtained in pot experiments, field experiments are being conducted for determining the variations due to climatic and cultural conditions as also to find out the most economic doses of sulphate of ammonia, castor cake and superphosphate that can be applied to crops like ragi and jola.

Agricultural and Industrial Co-operation in Mysore.

BY

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Agriculture is the chief occupation of the people in the Mysore State and nearly $52\frac{3}{4}$ lakhs or 90 per cent of the population of the State subsist on this industry. With a view to improving the economic condition of agriculturists and their earning capacity, Government have been devoting special attention to the development of agriculture. They have granted concessions to ryots for bringing more lands under cultivation. They have instituted a special Department of Agriculture to advise and help the ryots about the best methods of cultivating various kinds of crops, by providing them with improved implements, such as, ploughs, harrows, seed-drills, and also with good varieties of seeds, manure, etc., at cheap rates of cost. This department gives them technical advice about the methods of raising crops and preventing diseases of them by frequent inspections. There is also a Department of Sericulture with a Special Officer who pays special attention to the development of that industry. There is a Veterinary Department

with branches at all the district head-quarters whose officers, by providing medical aid and advice, prevent the mortality of cattle which are a great asset to the ryot in Mysore. With all these facilities provided to our ryots, they have not utilized the beneficent measures adopted by Government to their best advantage.

There are now 1,233 co-operative societies in the Mysore State started chiefly for the benefit of the agriculturists. They have a membership of 51,377 with a working capital of Rs. 25,12,000 and are serving about 5,000 villages in the State. There are over 17,000 villages in the State and the co-operative movement has not brought all of them under its beneficent influence. Thus, there is ample scope for starting many more co-operative societies for the benefit of these agriculturists.

It is admitted on all hands that the Co-operative Movement has vast potentialities for raising not only the economic standard of the people but their moral and social standards also. Agricultural Co-operation means for the peasant better farming, better business and better living; better farming, because more capital will be applied to the land, better seeds, manure, implements and live stock will be obtained and expert advice will be available; better business, because the small ryot by combining with others gains all the advantages of wholesale dealers; better living, because economic prosperity and combination for better business purposes bring in their train well ordered social life. Agricultural Co-operation can help the agriculturists in the following ways :—

(1) It provides him with the capital that he requires for carrying on his occupation, at a cheap rate of interest.

(2) It enables him to utilize it most profitably and

(3) It enables him to sell his produce to the best advantage possible.

The first object is served by the credit co-operative society. The second is achieved by the formation of various kinds of societies, such as, societies for the supply of improved varieties of seed, of implements such as, improved ploughs, harrows, drills, etc., of machinery such as, sugar-cane mills and plants, the usefulness of which is experimented and established beyond any doubt by the Department of Agriculture.

But other forms of co-operation were attempted to directly help the ryot in his agricultural operations. The purpose served by and the number of such societies are noted below :—

	No. of societies.
1. For the supply of seeds, agricultural implements and manure	72
2. For the sale of agricultural produce ..	2
3. For lift-irrigation	1
4. For dairy-farming	1

The supply societies, started purely with the object of supplying to their members good seed, improved agricultural implements and manure, did not do much work for want of men and money. But nearly seventy existing credit societies discharged this function by utilizing a portion of their capital for such purposes. Of the seed supplied, the principal one is a variety of ragi seed recommended by the Agricultural Department after extensive and exhaustive experiments and tests as being best suited to the Mysore soil. Nearly twenty seven co-operative societies in the Bangalore, Kolar and Tumkur Districts won prizes for the best ragi crops.

The supply of implements was very limited as they were not available in sufficient numbers in the season at which they were in demand. The work of supplying manure was still less. A few societies purchased a small quantity of mixed manure and supplied it to their members.

There were also sale societies for the joint-sale of agricultural produce, such as, copra, areca-nut, etc. But these societies are still in their infancy and it remains to be seen how far they will work successfully, as success depends much on the loyalty, business-like habits and combined action of the members.

Taking the experience of the past several years into consideration, it has now been decided that no new special societies need be organized purely for agricultural purposes, as they can do very little work for want of men and money to start with. On the other hand, the existing credit societies will be fully availed of for taking up this agricultural work.

As Dr. Coleman has stated in his book on Cultivation of Ragi in Mysore, ragi covers one-third of the total cultivated area and is

the staple food for four-fifths of the people. The average annual value of the ragi crop in this State before the War can be taken at about four and a half crores of rupees. This represents roughly one-fourth the total value of all crops grown in the State. Similarly, it is said that there is hardly a type of agricultural implement in Mysore which does not find use in the cutlivation, harvesting or threshing of ragi.

In consultation with the Director of Agriculture in Mysore it has been decided to confine our attention this year entirely to increasing the area of H-22 ragi in the ragi-growing districts and arrange for the sale of improved implements, seeds and manure through the existing credit societies by utilizing a portion of their reserve fund or working capital. The chief implements recommended by the Agricultural Department, such as, Kolar Mission ploughs, cultivators, disc-harrows, Punjab Nahan sugar-cane mills and special varieties of sugar-cane seeds and special paddy mixture, will be popularized. With a view to successfully working out the scheme, the following decisions were arrived at after consulting the Director of Agriculture in Mysore:

(1) The Agricultural Department will supply information *re* places suitable for trying the experiment of co-operative supply of implements, seeds and manure through credit societies. The Department will also furnish a statement of annual sales of implements, seeds and manures in these places during the past five years.

(2) The Registrar will select suitable existing credit societies to transact this kind of business.

(3) Agricultural Inspectors are to keep in touch with the societies and assist them in their work of distributing agricultural supplies.

(4) Where stock remains in the hands of the societies unsold for a year, the Department of Agriculture is to arrange for their transfer to other places.

(5) Every society selected by the Registrar will set apart some money either out of its reserve fund or working capital for utilizing it to this agricultural business.

As regards the formation of special societies, such as, supply societies, co-operative dairies, sale societies for the joint-sale of

agricultural produce, societies for the disposal of live stock, societies for cattle breeding, insuring cattle, societies against fire and against accidents in agriculture, steps will be taken whenever the people are anxious to start such societies.

Similarly, the application of co-operative principles to industries in which small artizans are engaged, will confer a great blessing on the people engaged in them. The artizans are by nature illiterate and ignorant and they possess no business habits and methods. They work at their convenience and pleasure and are very unmindful of the future. The business carried on by the following class of people offers a good field for expansion:

Weavers (of cotton, silk and wool), carpet manufacturers, basket-makers, carpenters, cabinet makers, metal workers, sandal-wood carvers.

Societies started for these people should not only be able to finance them, but also, supply them with the raw materials required and find a sale for the manufactured articles. Weaving industry is carried on to a large extent in the Mysore State and the articles manufactured here are being sent to many places in Southern India. The majority of the weavers are addicted to bad habits and the difficulty of bringing them to work under proper discipline for a common purpose is in the way of the expansion of weavers' societies. We have a number of societies for these weavers, but only a few perform all the functions enumerated above. At the best, these societies provide the members with the capital they require and to some extent raw materials also, but they do not undertake the sale of the articles manufactured by them to the best advantage, owing to fluctuations in trade and the uncertainty of the market. With the improvement of these conditions, these societies are likely to develop on a large scale.

There is one other branch of industry for which the Mysore State is famous and which is making rapid progress during the past few years and that is sericulture. Co-operative societies can help the people engaged in sericulture to a large extent. They can help them with the supply of capital required by them, supply them with good disease-free eggs and arrange to sell the silk manufactured by them in a profitable market. These societies do not require much capital to begin with, but they require constant supervision. The

Superintendent of Sericulture has consented to select suitable places where such societies could be started with fair chances of success and to give them all technical advice. Special attempts will have to be made in the future for the formation and development of sericultural societies.

For the growth of the several types of societies enumerated above, a real desire to combine for the sake of mutual benefit must exist on the part of the people. The people for whose benefit a society is to be organized should at least be able to appreciate the advantages it will bring to them and the conditions which make it a success. These conditions are :— proper men to manage the working, punctuality of repayment of loans, an understanding faithfully carried out to declare existing debts and to borrow in future from no outside source and the employment of loans solely for the purposes for which they are taken. If people are desirous of starting any such societies they may at once apply to the Registrar of Co-operative Societies and he will render them all possible advice and assistance.

Before concluding this short note, it may be mentioned that the Co-operative Department is ready to help the small industrial and the depressed and the poor classes' societies in their initial stages by giving some small allowance for establishment charges and by having a special Inspector to guide such societies.

The Kirloskar Plough Factory.

BY

"Visitor."

With the introduction of improved methods of agriculture and the use of improved types of farm implements in this country a new demand has come into existence for these implements and we are being confronted with the question "Where to get these implements from ?"

So long as the ancient wooden implements were in use, the village carpenter provided the necessary tools and implements required by the men of his village, but the manufacture of improved iron implements is a task which is entirely outside his scope, and could be properly undertaken only by an industrial concern equipped for that purpose and possessing technical knowledge for this particular branch of manufacture.

The policy of importing all our implements from foreign countries has not been without serious drawbacks. Apart from the economic loss suffered by the country by a wholesale importation of foreign implements, there are several good reasons which forbid us from adopting this policy.

If the use of improved implements must attain the success to which they are entitled, their supply must be made dependable, the prices very low and they must be manufactured with full knowledge of the requirements of the Indian farmer and his conditions as well as a close study of his psychology.

It may therefore be interesting to the readers of this Journal to be acquainted with the progress made by Messrs. Kirloskar Brothers, Ltd., in the line of manufacturing improved farm implements which have now met considerable popularity in this country.

It was in the year 1888 that this concern came into existence in a small dingy shed in Bombay. It was established by Mr. L. K. Kirloskar who is at the head of this business and to whose untiring energy, perseverance, resourcefulness, grit and foresight the concern owes its present success and fame.

Until the year 1901, the concern was not very widely known. Efforts were made by Mr. Kirloskar early to start manufacturing industries, such as button making, pill box making, etc., but they languished for a lack of public sympathy and shortage of capital. Mr. Kirloskar was then working as a teacher of mechanical drawing in the Victoria Jubilee Technical Institute at Bombay, getting about 50 rupees per month and his handicaps to establish a manufacturing business unaided were numerous.

In 1899 Mr. Kirloskar left Bombay and established at Belgaum a business in cycles which had then newly come into this country. Mr. Kirloskar and his elder brother both managed this business and for a few years their trade went on lively. They started a small repair shop of their own run by a small oil engine and employed half a dozen workmen.

Mr. Kirloskar however found out that the cycle business did not offer any scope for his creative ability and his ambition to be a manufacturer and as soon as he had made up a small amount of money, he sold the cycle business and set up a small workshop and foundry outside the town.

In order to reach the largest number of customers Mr. Kirloskar's attention was attracted to the agricultural class which forms the largest body in our country. He decided to manufacture an article which will be found useful by the cultivators.

This is how the Kirloskar Factory entered into the manufacture of agricultural implements. The first article produced was a small hand chaff-cutter. It was exhibited at the All-India Industrial Exhibition held in Bombay in 1904 and made a very good appeal. The factory was kept busy for the next two or three years in turning these out. The number of workmen employed increased to about 30 and a few machines were added.

It was in the year 1906 that the first improved iron plough was made at the shops of Kirloskar Brothers and it laid the foundation on which the present huge business of this firm has been built.

The introduction of Kirloskar's improved plough was not however without utmost difficulties and for some time the factory all but gave up the hope of finding a market for their new product.

An iron plough was then an entirely new innovation. No one had used it, and like all improvements it met a severe opposition from the very class whom it was going to benefit.

It was therefore a red-letter day in the history of Kirloskar Brothers when after waiting for nearly 2 years they got an order for the first six ploughs they had made. The ice was broken. The Kirloskar factory built more ploughs and sold about a 100 next year. The Kirloskar plough had come to stay.

There was another trial in store for this factory. In 1910 a notice was served by the Municipality to remove the factory from the spot where it was located. Then followed an endless hunting for new places only to find that the game was fruitless.

Just then it happened that Shrimant Balasaheb Pant Pratinidhi, B.A., Chief of Aundh State, was on a visit to Belgaum. He knew Mr. Kirloskar and his ability and finding him in a plight offered to help him if he would establish his factory in his Aundh State. About eight years later when His Excellency Sir George Lloyd, Governor of Bombay, paid a visit to Kirloskarvadi, and said while making his speech " I think my Government has made a mistake in allowing a man like Mr. Kirloskar to go out of Belgaum, but I am glad that the Chief Saheb has profited thereby."

A piece of land about 32 acres near Kundal Road Station was granted by the Chief Saheb free for this factory and a sufficient loan placed at its disposal. The new place is 110 miles from Belgaum.

It is a story full of romance and adventure how Mr. Kirloskar and his trusty band of followers made their settlement at Kirloskarvadi as the new place came to be called by. They cleared the land of prickly pear and wide bush, made roads, prepared bricks and tiles, planted trees, built cottages, dug wells, erected their shops, set up machinery, fought with the elements, braved every thing and in a few months turned the wilderness into a happy colony of inhabitants.

A BIRD'S-EYE-VIEW OF KIRLOSKAR FACTORY.

The progress made by the Kirloskar factory in the past 13 years has been remarkable. The demand for Kirloskar ploughs increased by leaps and bounds and extensions were required to be made every year. More than 80,000 ploughs have been made and sold by the Kirloskar factory and the demand for them to-day is greater than ever.

The present plant of Kirloskar Brothers occupies an area of nearly ten acres and employs about 150 workmen. The main department of the factory consists of a large foundry equipped with two cupolas of ten-ton capacity. All cast-iron wearing parts of the implements are made by the "Chilling" process which gives a very hard surface to them and ensures long life to the implements. A number of ordinary and pneumatic type of molding machines are used in this department for quick and uniform production. The castings after they are taken out from the moulds are carried to the sandblast room

to be cleaned and pass to the grinding department. The mould-boards of ploughs are here ground and polished on special machines, which makes them shed the wet soil easily when working in the land and minimises the draft.

The Machine Shop is equipped with up-to-date machinery of every description including lathes of heavy duty, screw cutting and Turret type, single and multiple spindle drilling machines, milling, shaping and key-seating machines, a boring mill, a huge planer, a complete bolt and nut making plant , electric arc and oxyacetylene welding plant, power hammers, a Bliss press and a large smithy. The whole factory requires 150 B.H.P. In the pattern shop, you find some wood working machines for planing, sawing, etc.

A similar modern and up-to-date system is found in the office of the factory which is built some distance from the main plant. The handling of daily correspondence in four or five languages, advertising, accounting, purchasing and selling are carefully conducted and to keep the customer satisfied has been the motto of the place. A well-equipped printing press is also attached to the office where all kinds of forms and catalogues required by the concern are printed. A monthly house organ in Marathi called Kirloskar Khabar is printed in this press and is one of the popular periodicals in Deccan. A motion picture film of this factory showing the manufacture and use of their implements is also being made for exhibition.

In the Kirloskar factory, you will find a rare spirit of co-operation and loyalty, fostered by Mr. Kirloskar's regard for his men. He has tried to keep the men happy by providing all possible comforts to them and promoting their welfare.

The factory has a 8-hour-20-minutes day with 2 intervals for rest and meals. Free medical help under a qualified doctor is offered to the employees. The workmen live in neat houses each standing apart with a small garden in front and with electric lights and tap water. The children of the workmen go to a free primary school and when sufficiently old work half time in the factory.

There is a large hall called Samaj Mandir, erected on the most elevated place in Kirloskarvadi, with a seating capacity for 1000 where cinema shows are given and theatrical performances staged. After the working hours are over the workmen play English and Indian outdoor games and the wrestling pit is also enthusiastically attended. A fine library also forms part of the institution.

At present the factory is turning out ten varieties of ploughs for different soils and conditions and three types of sugar-cane mills. The factory also manufactures large number of chaff cutters, mhote pulleys with roller bearings, maize shellers, blacksmith's drilling machines, forges and fans as well as a large assortment of ornamental cast iron railings.

Some Implements Manufactured by the Kirloskar Factory.

These ploughs and other implements are most popular in the Deccan. They are also patronized by the leading States of India including Mysore, Hyderabad (Deccan), Rajkot, Bhavanagar, Nepal,

Pudukota and many others and the Bombay Agricultural Department has also been one of their largest buyers.

Apart from the industrial role played by Messrs. Kirloskar Brothers in providing suitable types of improved implements to the farmers, they have also done a good service in promoting social reform in this country. In the ranks of the workmen and inhabitants of Kirloskarvadi are people of all castes and creeds but you do not find any class distinction made in them. They all mix freely and the so-called low caste men of whom a large number is employed enjoy all the rights and privileges enjoyed by their social superiors. This harmonious and happy unity in the big family of Kirloskar Brothers has been brought about by Mr. Kirloskar's liberal ideas and the active interest he takes in the elevation of the backward classes as well as by his own example of treating people of all castes with equal regard.

Mr. Kirloskar is a good organizer. To make the business of the factory run like clock work and eliminate unnecessary supervision, every officer, foreman and employee is allotted a particular work and entrusted with certain responsibilities of his own. This systematic planning makes the business run in perfect order and its development becomes easier. In order that the factory may be run on the most modern lines, Mr. Kirloskar has sent four of his young assistants to foreign countries for training in engineering and workshop methods. The future holds out a great promise for this enterprising concern.

Wishing to place this business on a permanent basis and provide sufficient capital to cope with the growth of trade, Mr. Kirloskar incorporated this business into a limited liability company with a capital of Rs. 12 lacs in 1920, which was rapidly subscribed. For the past 2 years the concern has paid a dividend of 6 and 15 per cent respectively which shows the onward march of this firm.

The British Government has not failed to recognize the valuable work done by Mr. Kirloskar. They have conferred the Kaiser-i-Hind medal twice on him. Mr. Kirloskar is however always too busy in the workshops and too unmindful to make any practical use of this distinction. He is at his best when wearing his suit and oil smeared clothes and chatting freely with the boys in the shops. He is 52 years old, most simple in his habits, has never played

cards, smoked and chewed betel-nuts. His passion has been reading technical magazines and trade papers. Almost all his knowledge and his ideas have come to him through reading.

Since the establishment of the factory and factory town at the new place, the little known station of Kundal Road has come to such prominence and begun enjoying such big traffic that the railway company has since last year changed the old name and put up a new board bearing the word in big letters—KIRLOSKARVADI—"Home of Happy Workers and Kirloskar Ploughs."

Casein as an Adhesive in Spraying against Areca Koleroga.

BY

M. J. Narasimhan, B.A.,

Senior Assistant Mycologist.

The importance of spraying against the Koleroga of supari in the malnad has been gradually realized by the garden owners, owing to the benefits accrued from timely spraying, as contrasted with the loss sustained in unsprayed areas. The mixture that has been successfully used for combating this disease during the last twelve years, the Resin-Soda-Bordeaux, has the property of adhering to the surface of the sprayed bunches without getting washed off by the heavy malnad rains. The average rainfall may be taken as 100 inches but nearer the ghats, in areas such as Agumbe and Lakshmipur Hoblis, it goes up to 250-400 inches. The preparation of the Resin-Bordeaux mixture, as pointed out in the Bulletin on the Koleroga of areca, is as follows :—

(*a*) Five lbs. of copper sulphate dissolved in 12 gallons of water.

(*b*) Five lbs. of lime slaked in 12 gallons of water.

(*c*) Two lbs. of resin and 1 lb. of soda heated in 1 gallon of water till quite clear (about an hour): (*a*) was poured into (*b*) accompanied by constant stirring and then (*c*) was added to make up the complete mixture.

The addition of resin is necessary in order to make the mixture stick well in spite of the heavy rainfall. It is not unusual to find some of the garden owners using an additional quantity of resin with the object of making the mixture stick better.

Experiments were conducted in the laboratory with the object of using casein instead of resin-soda in the preparation of the mixture, following the experiments of Muller Thurgau in Germany :—

The Bordeaux mixture was first prepared in the usual way. To

24 gallons or 96 seers of this mixture was added a solution made of ½ lb. of casein in 2 seers of water, mixed with ½ lb. lime in 2 seers of water. Casein dissolves readily in lime solution, and forms lime-caseinate which on drying has the property of being insoluble in water. In order to test the adhesive qualities of the Resin-Soda-Bordeaux and Casein-Bordeaux mixtures, glass plates were sprayed with the two solutions, allowed to dry in a drying oven, and then placed under an artificial shower of water for 8 days continuously. The results obtained in this way were very promising inasmuch as the Casein-Bordeaux on drying again, was found still intact on the glass plates, while the Resin-Soda-Bordeaux showed signs of washing off. The mixture was found to adhere fairly well even when the quantity of casein was reduced. Experiments were also conducted to test which of the plates thus washed retained more of the mixture, but the results were not conclusive, as the weight of the mixture adhering on to the glass plates was very little. These laboratory trials under an artificial shower were considered sufficiently encouraging in their results as to warrant taking up field experiments. As a matter of fact, the impact of the rain directly on the branches in the areca garden is never very great as they are to some extent protected by the leaves except perhaps in exposed portions near the edge of the garden. After these preliminary laboratory experiments, the casein spray was also given a trial under the conditions prevalent in the areas affeected by the Koleroga of supari to see if it would be as effective as the Resin-Soda-Bordeaux in withstanding the heavy rains, and consequently in checking the disease. The appended table shows the details of the work done in this connection.

From the table it will be seen that casein spraying was tried in different areas with the rainfall varying from 100 to 300 inches. The spraying was done during June to July when the nuts were not much developed—particularly so this year—so that there was every chance for the disease to appear, as soon as the nuts developed. Also in areas where Resin-Bordeaux was sprayed, the disease made its appearance here and there in the garden but was at once controlled by respraying. It will be seen from the table that in all the gardens except one or two, the casein spraying was quite a success. Only a few trees were treated with casein in private gardens, where it is not advisable to try experiments on any large scale. On the Marthur

Place.	No. of trees.	Date of Spraying.	Size of the nuts at the time of Spraying.	Average Rain-fall.	Result.
Sagar Taluk.					
1. Marthur Farm ..	500	13—6—1922	Fairly developed.	120″	2 trees found infected on 29—8—1922 (½lb. Casein).
2. Hakkare ..	92	6—7—1922	Small.	100″—120″	No disease (½lb. Casein).
3. Talneeru (Karur) ..	73	20—6—1922	Small.	200″—250″	No disease (½lb. Casein).
Thirthahalli Taluk.					
4. Kerodi ..	45	17—6—1922	Small.	150″	2 trees infected (½lb. Casein).
5. Nagarvalli ..	35	19—6—1922	Fairly developed.	about 150″	No disease (½lb. Casein).
6. Aragudige ..	30	20—6—1922	Small.	about 150″	10 trees infected owing to a drizzle soon after spraying (½lb. Casein).
7. Asemane ..	26	29—6—1922	Small.	200″—250″	Mixture washed off soon after spraying (½lb. Casein).
8. Chimitagunde (Agumbe) ..	10	13—7—1922	Fairly developed.	300″—350″	6 trees infected, resprayed. (½lb. Casein).
Nagar Taluk.					
9. Sampekatte ..	25	9—6—1922	Small.	200″—250″	No disease (1lb. Casein).
10. Manjagalale ..	25	8—6—1922	Small.	200″—250″	No disease (1lb. Casein).
11. Do ..	25	12—6—1922	Small.	200″—250″	No disease (½lb. Casein).
Koppa Taluk.					
12. Hariharpur ..	25	3—7—1922	Fairly developed.	about 150″	No disease (¼lb. Casein).
13. Kavalkudige (Sringeri) ..	25	4—7—1922	Small.	150″	No disease (¼lb. Casein).
14. Nebi (Megund) ..	50	12—8—1922	Large.	200″	No disease (½lb. Casein).

Farm, the casein spraying was done for 500 trees right across the middle of the garden, the rest of the garden being treated with the Resin-Bordeaux mixture. In Sampekatte and Manjgalale, Nagar taluk, the strength of the casein adhesive was doubled, with very good results. In two places in Koppa taluk ¼ lb. of casein instead of ½ lb. was used with 100 seers of the mixture and as yet the disease has not made its appearance here also, though the disease in these places was known to be virulent every year. It is proposed to take up further work next year in order to determine the minimum amount of casein that must be used, sufficient to withstand the heavy rainfall, and to prevent the outbreak of the disease.

The advantages of using casein in preference to resin-soda are many. Casein can be easily made available in many of the dairies in Bangalore and Kolar Districts while resin has to be imported from outside Mysore owing to our large requirements. The cost of the mixture also will be reduced by one rupee per acre, seeing that the quantity of casein required for 100 seers of the mixture will be only ½ lb. as compared to that of 2 lbs. of resin and ½ lb. of soda.

Another advantage of using casein is that the preparation of the mixture on the field, is made very much easier. The boiling of resin and soda takes nearly an hour, and requires some experience in judging the right consistency, as in the case of jaggery boiling. It is not uncommon to see garden owners feeling some difficulty over this. Whereas in the case of casein the process is very simple and can be manipulated in the garden itself in a short time.

The appearance of the two mixtures on the bunches is rather marked. While the Resin-Bordeaux shows up, when dry, as a bluish white coating even from a distance, the colour of the Casein-Bordeaux on the bunches is not so striking. This is perhaps due to the colour of the mixture itself which is bluish, as well as the fine spreading qualities of the mixture over the surface of the nuts. Anyway the film adhering to the surface can be clearly seen even after the heavy rains. The casein does not appear to get spoilt when exposed to the malnad weather.

Many garden owners are willing to take up spraying with the Casein-Bordeaux mixture next year. Further work on this subject will be taken up during the next monsoon season.

NOTES AND COMMENTS.

Our Annual Field Day.

The Field Day of the Agricultural and Experimental Union, which was held on Saturday, the 11th November, 1922, together with the sessions of the Union held in Bangalore on the previous two days, marks the beginning of a new stage in the history of this organization. Never has the Hebbal Farm welcomed so large a number of Mysore agriculturists and notwithstanding the inclement weather never has a field day been carried through so successfully.

The purpose of these field days is two-fold. In the first place, it enables members of the Department staff to become more intimately acquainted with some of the leading practical agriculturists of the State and so enables us to get more closely into touch with the practical problems that confront us. No Agricultural Department can ever afford to ignore the views of the practical agriculturists and those views must be given great weight in planning any work for agricultural improvement. In other words an agricultural improvement is useless unless it meets the practical needs of the raiyats of the State.

In the second place, these field days enable our agriculturists to see what their Agricultural Department is trying to accomplish in its Experimental Farms. It enables them to see what care is being taken to ensure that the experiments tell us the absolute truth about a new variety, a new implement or a new method of cultivation. This is a matter of greatest importance. It is a mistake to suppose that the average intelligent agriculturist cannot understand the purpose of experiments and cannot see whether the experiments as planned by us will give us really accurate information. We were most profoundly impressed this year at the great and intelligent interest displayed by agriculturists, both members and non-members of our Union, not only in the experiments conducted on the Hebbal Farm but in the more technical and less easily understood experiments in the laboratories as well. The searching questions, asked by these

PLATE III

On their way to the wet lands. The Agricultural School buildings in the background.

Paddy Experimental Plots. Hebbal tank bund in the background. Three batches of members are seen here.

The work on sheep breeding attracted very great attention.

men, showed how keen their interest is in anything calculated to improve the agriculture of the State in general and their own agriculture in particular. The answers they received to these questions must, we feel sure, have convinced them that the Agricultural Department has nothing to hide but that it courts the fullest publicity for all its activities even where such activities lead to no successful result.

This is a matter of the greatest importance for an impression seems still to persist in the minds of some that the Agricultural Department is trying to fool the people into believing in new varieties of crops, new manures and new methods of cultivation which are in reality no improvement on those already in use in the State. Such an impression is, of course, highly absurd, for no Agricultural Department has a hope of success if it attempts to base its work in falsehood. In fact, I cannot conceive of any Agricultural Department's being so foolish as to attempt to do so even leaving out of account the long training in scientific honesty which every scientific worker receives.

A considerable proportion of the large crowd which gathered at Hebbal were agriculturists who do not belong to our Union. This was very gratifying to us all as it indicated how widespread the influence of the Department has become. Many of these will* become members of the Union and we shall welcome them gladly, but even if they do not, they will return to their villages strong supporters of the Department's work.

We shall not attempt to describe the items of work which those present examined. Experiments on a very large number of the crops grown in the eastern part of the State, were shown. New types of ploughs were demonstrated and tested. The work on sheep breeding attracted very great attention while the sale of cows and young stock from the Dairy attracted a very large crowd.

The accompanying illustrations will give some idea to those members who were unable to attend the meeting of some of the interesting features of the day.

In concluding we should like to refer to the social side of the day which was by no means neglected. All present were entertained to lunch by members of the Departmental staff and to tea by the

* Some of them have since joined the Union.—Secy.

students of the school. We wish to pay special tribute to the students and the cooks of the hostel on whose hands the whole work of providing and serving food was placed. They displayed the most self-sacrificing industry and enthusiasm in what must have been a very arduous task. The school sports furnished much entertainment to the guests while a concert given by the students of the school ended what everybody admitted was a most successful Field Day.

[L. C. C.]

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The Fifth Conference of Indian Entomologists.

The fifth conference of Indian Entomologists was held at Pusa early in February and the State was represented by Dr. K. Kunhi Kannan. The conference was not so well attended as in previous years as some of the provinces did not send delegates. But three of the Indian States had their representatives. The Medical and Veterinary Departments were also represented.

There were several interesting papers and discussions. The paper on "The Possibility of the serious American Pest of Cotton known as the Boll-weevil" resulted in a resolution advising the prohibition of the import of cotton or in the alternative the adoption of measures by which imported cotton is treated at the port of entry so as to exclude any of the insects harboured in the bales. The resolution is a little premature considering that the possibility of introduction has not been sufficiently investigated. The import of cotton during the past several years, without any restriction, has not till now introduced the pest and a few months of careful investigation of the possibility of introduction might have been usefully spent before recommending the drastic action proposed in the resolution. Among the other resolutions there was one recommending the introduction of Entomology in the Indian Universities as a subject of equal rank with Zoology, Botany and Geology. We trust some at least of the Indian Universities will see their way to accept the recommendation. Entomology as a science is growing in importance day by day on account of its intimate connection with human welfare and endeavour and wider diffusion of the science is necessary to increase the number of workers in the field and speed up entomological investigation.

This resolution was moved by Dr. K. Kunhi Kannan. He

moved one other resolution and read three papers of which one related to the new remedy he has devised against the sugarcane borer. [K. K. K.]

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Diseases of Silkworms in India.*

The report on the Diseases of Silkworms in India prepared by Dr. Pringle Jameson is a welcome publication. It surveys the problems of silkworm diseases from an eminently practical standpoint and indicates the broad lines on which control of the disease may be brought about. The language is simple and divested as far as possible of scientific terminology so that the lay reader can follow the account intelligently and with care. Dr. Jameson believes that for efficient control of Pebrine the method devised by Dr. Hutchinson is too laborious and costly. While admitting that Dr. Hutchinson's method makes for more thorough exclusionof disease he would have it adopted only in the central nurseries. For the other nurseries and grainages Pasteur's method is recommended. The other recommendations made are equally practical.

Dr. Jameson rightly emphasizes the importance of the human factor and insists that control of the disease rests not only with the officers of the Sericultural Department but with the raiyats themselves. We agree that the staff of the Provincial Department should be men of the Provinces themselves who can converse with the rearers in their own tongue and understand best their requirements and prejudices. The health of the worms will depend on their environment which again depends on the environment of the rearer himself. In other words, unless the economic conditions of the rearer improves the environment of the worm cannot alter for the better. A great deal may be done by propaganda, practical demonstration and Co-operative Societies and Government aid to selected rearers. As far as possible, these last should be encouraged to supply disease-free seed. All these are eminently sensible and practical and Dr. Jameson deserves the thanks of the public for producing for their benefit so practical a report.

We note with pleasure that Dr. Jameson commends some of the lines of sericultural improvements followed in Mysore. [K. K. K.]

*Report on the Diseases of Silkworms in India—A. Pringle Jameson, D.Sc. (Protozoologist to the Government of India), Superintendent, Government Printing Press, Calcutta, 1922.

Results of Rearing Silkworms.

In our issue for December 1922 (Vol. IV. No. 4). we published a speech by the Superintendent of Sericulture wherein he referred to some hybrid races of silkworms which the Department had recently succeeded in fixing. The following results of private rearing by raiyats under the usual village conditions may be of interest. It must be borne in mind that the average yield for 100 layings of the Mysore race is 35 lbs.

October.—

Channapatna and Malurpatna.	Average yield for 100 layings.
Mysore-Chinese, (both green and white) Quantity reared 760 layings.	.. 66 lbs.
Mysore-French, white	.. 50 lbs.
Mysore-French, green	.. 55 lbs.

November.—

Mysore.	
Mysore-Chinese, white 200 layings.	.. 63 lbs.

December.—

Chamarajnagar.	
Mysore-Chinese, (white and green) 470 layings.	.. 78 lbs.

This last was in an area where all attempts to introduce Sericulture had failed in the past. The almost phenominal success of the rearing (under the supervision of a passed student of the Mysore Central School of Sericulture) has evoked a burst of enthusiasm as a result of which nearly 60 acres are going to be planted with mulberry.

The time taken for a rearing with the new race in these cases was from 26 to 28 days. the usual duration of a rearing with Mysore worms being 32 days.

It must also be mentioned that while it takes 15 lbs. of ordinary Mysore cocoons to get a pound of charka-reeled raw silk, this result can be got with no more than 12 lbs. of the new race cocoons. [N. R.]

Live-Stock Improvement.

In connection with the question of the improvement of Live-stock in Mysore, it is of interest to quote from one of the earliest writers on this subject. The writer in question was Gervaise Markham, an Englishman, who published in 1620 his "Cheap and Good Husbandry" in which is found the following paragraph :—

"For as much as the Males of all creatures are the principal in the breed or Generation of things, and that the Fruit which issueth from their Seed participates most with their outward shapes and inward qualities, I think fittest in the place where I intend to treat of Horned Cattle and Neat, to speak first of the choice of a fair Bull, being the breeders' principalist instrument of profit." (pp. 71).

Markham's recognition of the prime value of a good sire in stock raising has been borne out again and again in the experience of stock raisers up till the present time. However, the fact still seems to need acceptance and appreciation by many people, actively engaged in raising domestic animals. The recognition of this necessity and action in regard to it, is the first step towards good Animal Husbandry.

[W.D.]

* * * * *

The Ontario Agricultural & Experimental Union.

We publish the following facts and figures relating to the Ontario Agricultural & Experimental Union in the hope that they will serve as a stimulus to such of our members who have not undertaken any kind of experimental work as yet.

"The Co-operative experimental work in field crops alone has now been conducted for thirty-seven years, during which time there have been 100,801 distinct tests made throughout Ontario. Each of these experiments consisted of from two to ten plots. The following figures show the average yearly number of experimenters with farm crops actually engaged in the work in each of two twelve-year periods and for the last thirteen-year period :

Periods	Years	Average number of experimenters per annum.
1886-1897	12	896
1898-1909	12	3,640
1910-1922	13	3,574

The number of experimenters within the last thirteen years has varied from 1,616 to over 5,000. This variation was due to conditions caused by the war, by labour scarcity, and by the varying prices of farm products."

* * * * *

Personal.

Our President is leaving us on the 28th instant for a period of eight months. We wish him a safe voyage, a pleasant stay in his Home and a speedy return to Bangalore with renewed health and vigour.

CORRESPONDENCE.

To

THE EDITOR,

The Journal of the Mysore Agricultural and Experimental Union, BANGALORE.

Sir,

I have perused with great interest Mr. Kurpad's article on "Agriculture as a Vocation" and your supplementary comments on it. A very interesting article bearing on the subject appeared among your "Selections" in Vol. I. No. 1 of the Journal. Some at least of the causes underlying the "disinclination of agricultural students" to take up agriculture as a vocation are stated in that article and I wish merely to invite the attention of your readers to it.

Among the students who studied in our Agricultural School in the past, there have been some who possessed sufficient land and the requisite amount of capital to work it. These were few and most of these few are now engaged in farming. How far they have been successful I cannot say but that Government service has not been an attraction to them is obvious. In fairness to them and to others who have passed out of the School it must be said that almost all of them were shrewd enough to find out very soon that "all the paraphernalia necessary for an experimental farm run on scientific lines and irrespective of cost" are not necessary for their own farms. Having been a student in two agricultural institutions, I can say this with certainty. Be it as it may, there is no use denying the fact

that training given on a farm run on *business lines*, private or Government, would have great value.

But the larger part of the men, who entered the School, have not been of the type referred to above. They have either been those who possessed a small amount of land but not the capital either to purchase more land or to cultivate the land they already possessed on improved lines, or both, or those who advanced as an argument, the fact that thier relations possessed lands (for that was a necessary qualification for admission to the School) themselves possessing no land. Little need be said as regards the latter type of men. But it is about the former type of student whose intentions in entering the Agricultural School were honestly to return to his land after training, that I wish to say a word.

The man who has plenty of land and capital needs only training, and inclination to pursue agriculture as his business. The man who has no land and who has no capital and who manages to take an agricultural training somehow necessarily seeks Government service for that must have been the intention with which he joined the School. If he fails to find a job in the Agricultural Department, he tries other branches of public service and neither the institution which trained him for agriculture nor the man himself need be ashamed of the course he adopts for he must live somehow. Such a man must simply be left out of account unless some one is prepared to advance him both land and capital and try his luck. But the other type of student, I believe, really deserves help. He has some land but perhaps the situation of the land is such that he cannot extend the area due to various reasons. Or it may be that his lands are all in bits, at distances, and there is little prospect of consolidation. Or perhaps his lands are in the midst of those of a rich land-lord who is ever aiming at establishing a zamindari by driving out the lesser but independent landowners. In a circumstance like this, the land instead of being an asset to him, becomes a nuisance and he finds that the sooner he gets rid of it for what fair price he can secure the better for him, for he can then move on to a more favourable place. This is one type of student.

Another type of student who also possesses a small amount of land needs capital to extend his holding and make it an economic

one. Where is he to go for capital ? To the money-lending merchant ? To the Co-operative Society ? To the Government for a Takkavi or Land Improvement loan ? Is there any one who seriously thinks that any one of these agencies or a combination of them is either sufficient or suitable ? I believe the limitations of these agencies is obvious and do not wish to discuss them here. You have got nothing like a land bank in this country.

But Mr. Kurpad disposes of the question of capital in a word. I should like to know definitely what exactly the Director of Agriculture will be able to do in this matter.

Supposing a student, coming under any one of the two types I have mentioned above, sat down with a determination on his land to cultivate it on improved lines, you will actually find little difference between his agriculture and that of his somewhat enlightened neighbour. If he cannot soon show that his methods are superior to and more profitable than that of his neighbour he soon becomes the butt of general ridicule. Sympathy is a rare quality over there in the village.

Is there no way of helping this type of agriculturally trained, ill-circumstanced but good intentioned student ? He comes to you with a security : he is not a pauper. This is somewhat the question which a small body of highly educated and experienced officers of the Mysore Agricultural Department sat down some years ago to answer. They formulated a Scheme for the formation of a Colony of Agriculturists trained in improved Agriculture. The first action taken on the Scheme was to publish it in our Journal and the last was to read and forget it. Is it then wonderful that you are not progressing much ? If it is not, please do not complain that your trained men are not going back to their land. They need not be told that there is dignity in the profession of Agriculture : they know it, all of them. They stand in need of some substantial help.

Yours sincerely,

February, 1923. N. VENKATSUBBIAH.

SELECTIONS.

I

Topping and Suckering Tobacco.

The height at which a tobacco plant is topped and the time at which it is topped have a very appreciable influence upon the quality of the final product as well as upon the yield. For early uniform maturity the plant should be topped just as soon as the bud appears or the number of leaves it is desired to leave on the plant have developed sufficiently to permit the operation to be performed. Allowing the flower stalk to become long or flower out before topping retards maturity and has a tendency to become woody very rapidly if the flower stalk is permitted to remain on the plant too long, and, as a result, the development of the leaves is not so rapid or complete on a late topped plant as on one topped at the proper time. For that reason late topping frequently results in a decreased yield.

The height of topping will depend upon the earliness, robustness, and vigour of the individual plant, the fertility of the soil, and the character of the season. Since the plant requires, normally, from thirty to forty days after topping to mature, an early crop may usually be topped higher than a late crop; and, too, a plant which is making a vigorous growth may be topped higher than a slower growing or more woody plant. Tobacco growing on fertile soil or in a season of fair rainfall may also be topped higher than tobacco growing on poor soil or in a dry season. The aim in topping should be to leave only as many leaves as the plant can bring to the fullest development. While topping too low results in the production of a coarser heavier-bodied leaf and a decrease in yield, topping too high does not increase the yield and does retard the maturity of the crop and also results in the production of a lighter bodied leaf and a leaf of poorer quality. The tobacco plant ripens from the bottom to the top and when topped too high there are usually from three to four leaves in the top which never ripen and which cure very unsatisfactorily, as a rule, and are very light-bodied and papery.

On account of replants and undersized plants, it is usually necessary to go over the field twice at different dates in topping. The second time the plants should be topped about two leaves lower than those topped at the first operation in order to make the field ripen more uniformly.

Usually, from eight to ten leaves, exclusive of three or four undeveloped bottom leaves, are enough to leave on plants of the flue-cured type ; and from twelve to fifteen on the burley.

About a week or ten days after topping the plant will begin to produce suckers. These should be broken off when between three and four inches long. To leave them on the plant longer results in a great loss of plant food and consequently a poorer yield : and, too, if left too long they become woody and are much harder to break off, without taking the leaves with them, thus increasing the cost of production.—*Seasonable Hints, No.* 23.

II

Implement Sales Prospect in India.

There is a new spirit of enterprise awakening in the East and especially in India is it taking the form of the adoption of Western methods of cultivating the soil. Primitive implements are being gradually discarded in favour of the more efficient modern types, and there is scope for British manufacturers to introduce models particularly suited to Indian conditions. The situation, however, is not so simple as it seems, and a wholesale rush of goods to India would be as harmful as it would be wasteful. Judicious inquiry, however might reveal possible lines of action, just as certain information we have indicates how utterly impracticable it would be to try to introduce specific forms of machinery. Wise selection must be made. For example, figures quoted in the Journal of the Mysore Agricultural and Experimental Union show that potatoes can be harvested at a cost of 6 rupees per acre, or, to put it in another form, 208 maunds of potatoes (about 5 to 6 tons) can be dug for the same expense. Contrast these figures with the cost of mechanical potato digging at the latest big trials in this country—viz., over £3 per acre on the average, and it will be seen that potato diggers have no immediate opening in India. Nor have many other labour-saving implements that seek to compete with hand labour, which is obtainable at less than £1 per month : but where implements for use by hand are concerned, such as ploughs, there are the possibilities of good trade, always provided the article is low in price and of the type required in the country. The demand for better ploughs, indeed, is quite noticeable. Competitive tests are being made in many parts of the country to try to discover the most efficient type of tillage implements for Indian conditions, a primary essential being low price. One of these tests was recently conducted at the Mysore Agricultural School on land previously used

as a playground, and which had never been ploughed before. Each plough was worked for an hour, and the extent of the land ploughed and the wear on the implement were noted. The "Kolar Mission" plough of 48½ lbs. weight gave good inversion and pulverisation with a furrow slice 8 inches wide by 5 in. deep. The draught was 3 cwt., the resistance 8.4 lbs. per square inch, and the area ploughed reached 4,000 square feet. The wear on the share was 1/16th of an inch, though the length of point available was 1½ inches, the cost of the share being Rs. 3-8. The "Verity" plough of 83½ lbs. made very good inversion and good pulverisation, with a furrow slice 10 inches by 6 inches. The draught was ½ cwt. more, and the resistance only 6½ lbs. The same area was ploughed, the same amount of wear recorded, and the share, with the same length of point, cost Rs. 4–2–0. With the "Hebbal" plough, of 60 lbs. weight, good inversion and very good pulverisation were obtained. A furrow slice of 8 by 5 inches was turned, the draught was only 2½ cwt., and the resistance 7 lbs. The area ploughed totalled 3,500 square feet, and the wear on the share, which had a 10-inch point available, was 1/12th of an inch, the cost of the share being Re. 0–12–0. These figures should afford British manufacturers some idea of the points to which Indian agriculturists pay most attention, and also of the cost and the conditions under which the implements are worked. Of equal importance is it to know that it is the considered statement of the Director of Agriculture in Mysore that many of the large landholders feel that they will never be able to bring their extensive holdings under cultivation unless and until they can call to their aid modern tillage equipment.—*The Implement and Machinery Review, Vol.* 48, *No.* 572.

III.

Sugarcane Trash.

After the harvest of the cane stalk for milling purposes there remains a mass of foliage and tops of the cane (cane trash) to be disposed of before the next crop [stubble (ratoon) plants, cane or rotation] is started.

These tops and leaves contain the greater part of the plant food (nitrogen, phosphate, potash, and lime) that the growing cane plant has removed from the soil. The roots and butts cut off at harvest remain in the soil, regardless of the future cropping of same, and but a small portion of the plant food is removed by the stalk.

The amount of this residue varies with the maturity and the yield of cane, and is relatively large in every harvest, heavy mature canes giving a smaller proportion of tops and leaves to stalks than the lighter

or partially mature crops. These tops and leaves are valuable, both as a fertilizer and as a food for animals, or a further possible use as a source of alcohol (one, however, not likely to be of economic importance under present conditions). Their greatest value is the nitrogen, and as a source of humus to the soil. Their utilization for this purpose, as well as the fertilizing value, has been the aim of all sugar agriculturists.

The difficulty is the cultivation of the land with this trash. It is so thick and decomposes so slowly that the plows or cultivators cannot be used either in preparation of the land or in the subsequent cultivation of same, without its removal.

Trash cutters have been advocated to shred and cut this trash so as to render it in a condition that will permit the utilization of these implements. The successful application of these has not been accomplished. The rush of the harvest season, demanding heavy tolls of all labourers and the necessity in tropical countries of the care and cultivation of the growing crops, the planting of new crops and attention to the stubble of the harvested cane, has resulted in the adoption of the easiest means of removing this trash by burning. This destroys the humus and nitrogen, and leaves only the mineral constituents on the land.

About 20 years ago, one of the managers of an Hawaiian plantation, Mr. Webster, determined to utilize this valuable fertilizer by piling the trash in the alternate rows in the cane field, thus being able to cultivate every other row of the stubble or ratoons or cultivate one-half of each row. At that time our entomologists were of the opinion that this trash was a harbor for the cane borer, and disapproved of the retention of it in the cane fields. The results in Hawaii were pronounced, and the borer was found not to have used this trash as a haven for propagation, but it was noted that, where the trash was allowed to remain as a mulch on alternate rows of cane, the borer was not as numerous in these fields. The cause of this is now accounted for by the presence of parasites of the cane borer on the cane leaves, either in the egg or subsequent stages. Entomologists by more extended study of the habitats and enemies of the cane borer have reversed the first recommendations of the destruction of this trash by burning and now advocate the utilization of the trash, if possible, in order to propagate these parasites.

The success of this utilization of cane trash in Hawaii, giving as it has a marked increase in the yield of the areas where it was applied, has led to the adoption of this method wherever practicable. Cultivation is extended to include the breaking up of the land and even the

fertilization of the clean row, reversing the trash and following the same method on the row where the trash has been permanently removed, following this with the usual cultivation, thus having a well-prepared soil and cultivation continued on all rows. The necessity of moving this trash by hand or crude appliances has been a drawback wherever careful cultivation is employed.

Cuba has allowed this trash to remain as a mulch on the fields practically since the growth of cane in the island, the primary objects being to conserve moisture during the dry harvest season, and keep down the weed growth. With the advent of better methods of cultivation, and the necessity of greater yields to supply the increased capacity of the factories, methods of handling this trash to advantage has become a problem. In Porto Rico the cultivation of the alternate row in ratoons has been in successful practice for quite a length of time, with the same favourable results as obtained in Hawaii. It has been noted there that, in fields accidentally burned or where fires have occurred before harvest, the young sprouts from the stubble were frequently badly attacked by the cane borer. While in fields the trash was retained in alternating rows the attack of the borer was not nearly as bad.

Louisiana planters in recent years are practising methods of utilizing this appreciated but troublesome trash, and at the same time form a harbor for the propagation of the parasites recently introduced for the control or destruction of the cane borer.

With these few of the many instances of the utilization of the value of this cane trash before us, practical means of clearing the way for preparation and cultivation of the lands, without the destruction of its best qualities by burning, are presenting themselves. The utilization of a side delivery rake in removing this trash from row to row as necessities demand for the proper preparation of the soil before the stubble cane appears is an efficient and rapid means of handling this problem.—*The Louisiana Planter and Sugar Manufacturer, Vol. LXIX, No.* 3.

IV.

Suitable Shade for Coffee.

It does not do to dogmatize as to any particular tree or trees fulfilling all the requirements of shade for coffee, having regard to the varying conditions under which the fragrant berry is grown. Trees under which coffee thrives in one district prove positively deleterious to the plant in another, perhaps not a dozen miles away. The great rule to

observe in the question of shade is, where the coffee is doing well, not to interfere. This useful rule is sometimes honoured in the breach than in the observance. Some planters not infrequently take a prejudice against certain trees, and irrespective of the fact that the coffee under them is in a flourishing condition, ruthlessly eliminate them. Where, of course, trees are observed to have a detrimental effect on the coffee, after other means have been tried to improve it without success, it is the right thing to do to get rid of them after providing temporary shade like *Erythrina lithosperma* and silver oak to take their place.

Trees planted with or after the coffee plants have been put down are spoken of as "artificial shade" in contradistinction to original jungle trees left when clearing the land, for the purpose of providing shade. In the Mysore planting districts it was generally the practice to plant coffee under forest shade: but where there was a deficiency of it, or where trees were blown down or eliminated for any cause, they were replaced by artificial shade, and, in some cases the practice of making a complete clearance of the forest was carried out and shade planted with coffee. The trees favoured for the purpose were *Ficus glomerata*, *Ficus tuberculata*, *Ficus infectoria*, *Ficus mysorensis*, and *Artocarpus integrifolia*. These remain the prime favourites generally to this day, though some are objectionable because they are too dense for positions where rainfall is heavy. The Ficus tribe become old and are objectionable as permanent shade on that account: but coffee seems generally to thrive under them for an indefinite period. When they become deleterious they can be eliminated, and other trees substituted for them. *Ficus glomerata* is attacked by a parasite which spoils its spread, so is also *Artocarpus integrifolia* and another objection to both these trees is that their fruit attract game and cattle in large number. The first named is also subject to a scale which sometimes kills the tree and the saccharine deposit from the scale with which the coffee trees in its vicinity becomes covered seriously affects the bud. Several other trees are also affected with the scale, amongst which may be mentioned *Acrocarpus fraxinifolius* and *Cedrela toona*. *Ficus glomerata* was at one time regarded as an almost ideal shade for coffee, because it shed its leaves during the height of the monsoon, when shade is not required and put forth new foliage after the cessation of the rains, but the foliage is too scanty for situations where the rain-fall is light, and it becomes exceedingly scraggy when old. It is suited to positions where humidity is somewhat in excess. Another serious objection to the ficus trees is that when they become old, the roots in the vicinity of the stems come up above the ground, but they should be eliminated long before they have

reached this stage, and other trees substituted for them, these last being planted early enough to make efficient substitutes when the former are eliminated. *Acorocarpus flaxinifolius* and *Cedrela-toona* have been tried and found wanting as shade. The objection that they are subject to scale has already been noticed. In addition the foliage of the former is not dense enough for dry situations ; and the fact that the latter is no protection against the borer as it loses its foliage at a period when the hatching of the insects' eggs is most active, is a serious objection to it. Latterly *Grevillea robusta*, *Albizzia molucana* and *Erythrina lithosperma* have been largely planted out. The first named meets the demand for a tree of rapid growth, but the chief objection to it is its scanty spread which necessitates a large number to the acre. It is in great favour as a shade in Java. Mr. Huidekoper of the National University, Adyar, in a *lecture on the coffee industry in Java, delivered at Chickmagalur on May 18th of 1921 to an audience of Mysore planters, claimed for the tree when it is full grown that it has good crown. Our experience of it is just the opposite, for as it grows it sheds all its branches till it assumes the appearance of a palm tree. To remedy this, topping the tree after it has made some considerable growth has been tried with indifferent success. The immediate effect of topping is to make the trees throw out a number of suckers which develop into stems. In order to make the trees spread laterally it would be necessary, as in the case of coffee, to remove the suckers as quickly as they appear, and this would not only be too costly but would consume labour that can be ill-spared. *Albizzia molucana* was planted somewhat largely in South Coorg about 1872. It answered fairly well till it became old, when the coffee under it began to suffer in the dry weather, the branches dying back. It is a leguminous tree and, in common with other trees of this order, owing to oxygen being essential to the bacteria in the nodules on their roots, the surface soil is permeated to such an extent by them as to deprive the coffee largely of moisture. Coffee under *Dalbergia latifolia*, another leguminous tree, is particularly dry at this period of the year ; and rain, which is sufficient to bring out the bloom on the coffee generally, usually fails to bring it out in the vicinity of these trees. Coffee under jack trees, *Artocarpus integrifolia*, also droop badly during the dry season, but for quite another reason, and that is, being an ever green, it acts like a pump in depriving the coffee of moisture by transpiration. In fact all trees that are in foliage during the driest period act detrimentally in the same way. It is for this reason that *Terminalia belerica* and

* *Vide* Vol. III, No. 2, of this Journal.

Schiejchera trijuca (the Ceylon Oak) make ideal shade for coffee. They shed their leaves at the beginning of the hot weather, providing the ground with a heavy mulch of leaves which keeps the soil moisture where it is most needed, that is about the coffee roots. Though *Erythrina lithosperma* is made use of as a temporary shade, its principal function is to supply the coffee with green manure. It is claimed that a ton of its loppings contains 61.50 lbs. of nitrogen, 57.38 lbs. of potash, 14.92 lbs. of lime and 13.68 lbs. of phosphoric acid.

The same species of trees that are used for shading coffee in Mysore are used in Coorg also with the addition of the two *jats* mentioned above previous to *Erythrina lithosperma* ; but in the latter place it is recognized that there can be no permanent shade ; that after trees have become old, they must give place to young trees of mixed varieties— rotation in shade ! It is hoped by doing this to bring about an alteration in the nature of the soil. In the words of the late Mr. R. D. Tipping, writing to the *Madras Mail* on the 15th September, 1905 : "By growing a variety of shade trees supplied up regularly with young shade, differing from that already growing whilst the older shade is being gradually eliminated, we shall, I think, assist in altering the nature of the soil."

The great desideratum in the cultivation of it is, whilst providing for the adequate shading of the coffee, to so treat the shade trees as to insure a minimum number of stems per acre. In order to guard against the dying out of trees causing vacancies, shade trees are, in the first instance, planted far more closely than they need be, and the mistake is made, instead of eliminating the surplus trees when their branches begin to overleap, of lopping up the branches to ensure the necessary light reaching the coffee. This destroys all chance of their attaining their fullest lateral development and the trees generally have narrow heads, and the fields are crowded with a far larger number of stems than are necessary.

The usual method of eliminating old or undesirable shade trees is by "ringing" them, that is, cutting a deep groove all round into the stem of the trees. There is always the risk of the decaying tree developing "stum rot," a disease caused by a fungus, which has been identified as *Rosellinia radiciperda*, which after attaining sufficient vigour to do so by living on the roots of decaying trees, attacks the living roots of the contiguous coffee trees, bringing about their death. The only means of combating this disease is to dig a three-foot trench round the decaying tree so as to include all roots of a larger size than 2 inches in diameter, then heavily liming and digging the affected area before

replanting it. If the trench is dug directly the tree has been "ringed," it will result in the saving of many more coffee bushes than if it is deferred till the disease has started.—*The Planters' Chronicle, Vol. XVII, No.* 24.

V.

The Ram and his Characteristics.

Frequent enquiries are received by the writer as to what constitutes a good ram, and an endeavour is made in the following notes to present the main features which are essential for success.

There are several important characteristics which a ram must possess when it is intended to purchase, or, having bred the animal to keep him, for propagating purposes. These characteristics are constitution, trueness to type, vitality, virility, character, good bone, conformation, and wool of as even a quality as possible possessing character, density, and length.

The most important quality is constitution, strength, hardness, and robustness, because it is the foundation of the animal. Having this, providing he receives the feed he requires and some shelter which he can make use of during severe weather, the ram is able to develop and bring all the other qualities he possesses to the highest point within his power. A sound constitution should be every breeder's aim, as it means less trouble and work, therefore less worry, than when the animal has to be hand-nursed. The only way to secure constitution is by mating the strong with the strong. Further, the progeny should never be pampered.

It does not matter which breed the ram is from, he must be as true to his type as it is possible to get him. Each line or breed has its own particular type, and it should therefore be seen that he possesses all the requisite points. A little time given to careful examination is well spent. See that he is as good as can be got (or financial circumstances will allow) before mating him. As a rule a good ram is worth more than the price paid for him.

Vitality comes next, as the ram must be able to withstand all calls made upon him whether by nature or otherwise. With good vigorous vitality he survives and quickly recovers from any reverses he may meet with.

Virility is very necessary. As the ram is only kept for one purpose it is advisable that careful attention be given to his generative organs prior to mating, in order to observe whether any injury has taken place.

There is an advantage in keeping young rams, as their virility is greater, therefore they are keener workers, and the result is always apparent at lambing-time. The old ram has lost a great deal of his keenness.

Character is required, and will always show when it is there, by the conformation, bearing, and general carriage, with a leadership look about him. This is true reflection of his breeding, and always bespeaks a good pedigree. The way to breed character in is by mating the best with the best.

The bone should be strong, as it is the framework and support of the animal. Any defect in this respect should put a ram out of consideration.

The conformation should be of a general uniformity throughout. The head should be well set on, with a strong masculine appearance, good crest, fair width between the eyes and ears, orbits nice and full, jaws strong, in line, and nicely rounded at the mouth so as to come together evenly, teeth level and strong, the cutting-teeth in the lower jaw to fit evenly against the cartilaginous pad in the top jaw. There should be a good scrag, strong neck and wither, complete absence of "devil's grip,"* large full shoulder, nice broad back with ribs well sprung from backbone and feeling solid with good spring, good loin, rounded rump, full thigh, and a deep wide chest so as to allow plenty of room for the heart and lungs to do their work properly. This means a large girth, a well-balanced body, with nice strong legs nicely set apart, with good knees and hocks, strong springy pasterns and fetlocks, and muscles firm and strong. Hoofs of black or deep amber are to be preferred, these appearing to be harder and capable of offering greater resistance to wear and any hoof trouble. Some breeds have large hoofs for the size of the animal.

The wool should be of as even a quality all over as it is possible to get it. Of course, there is always a slight difference in the quality of wool growing on the fore part of the sheep and that growing on the hind quarters. "Quality" implies that the wool must possess character, trueness in the fibre, lustre, soundness, elasticity, pliableness, evenness, fineness according to the breed, free growth, density in fibre and growth, length, shaftiness, colour, and yolk. The hair growing on the face and legs is a good indication of the quality of the wool grown by the animal; the hair close to the ears should have a soft downy feel. Character in the wool is signified by the waves or crimp in the fibre being the full length of it—that is, from the base right out to the tip. Such wool

* "Devil's grip" is a depression behind the shoulder, and indicates weakness.

possesses elasticity, pliability, and softness. When wool has this quality it is referred to as "full of character," a very desirable feature in all wools. Trueness in the fibre means having the same diameter throughout its length, and the waves or crimp even in shape and the same distance apart from base to tip. Lustre is required, but it varies with the different breeds. Soundness is shown when the wool will stand a strain or tension put upon it without breaking. As regards elasticity, the wool should stretch when tension is applied, and upon being released should immediately return to its natural length. The true length is ascertained when the wool is stretched. Evenness implies the same quality all over. It has already been pointed out that there is a slight difference, but the wool must not be fine on the fore part and going to hair on the hind quarters. This is termed "run out," and any ram having this serious fault must be called out. As regards fineness, each breed has its own particular form, but it should be a robust fineness. Every breed also varies in length, but the wool must be long enough for combing purposes. With Merino rams the ones with the longest-grown wool should be chosen in preference to those whose wool is short; also, the horns should take an even curve away from the head. Density is valuable, as it signifies a more copious growth of wool on the area of skin and indicates carefulness in breeding. Dense wool offers greater resistance to the dirt and weather element, and such wool always feels solid. "Plenty of body in it" describes such wool, and it cuts a good weighty fleece. Wool that has no density is light and open, and the weather has full play upon it, which dries out a lot of the yolk, causing depreciation, the result being an unduly light fleece. Shaftiness means a good compact vigorous growth and nice length. Yolk is the natural preservative of the wool, and varies in quantity and quality according to the breed. A healthy free flow of yolk is desirable; it acts as a protective in resisting wet, assists the growth of the wool, makes the wool soft and pliable, and keeps the fleece from becoming cotty or matted.

Every breed possesses its own distinctive qualities of wool, from the long lustrous Lincoln and English Leicester, the demi-lustre Border Leicester and Romney Marsh, the blocky stapled Corriedale, the various Down races (Shropshire, Suffolk, Southdown, etc.), the Ryeland, to the Merino. In the ram the general features or characteristics of his breed must show clearly. A rubbishy one is dear at any price, as he will give endless trouble if mated.

If unable to buy enough good rams in one season for the whole of the ewe flock, the farmer should purchase one or two good animals, select fifty of his best ewes for each ram, mate them, and mark the ewes

put with each ram, also keeping a record of it in the note-book. Let the ewes run on the country they are going to rear the lambs on. When lambing takes place mark the lambs with the same mark as the ewes, afterwards making a selection of the best ram lambs for keeping, and when they are old enough mate them with the other flock-ewes. In this way the quality of the flock will be gradually built up.

The class of ram not to use is one which possesses any of the following faults :—Weak constitution, feminine head, narrow face, pinched peaky nose, overshot or undershot jaw, thin or short neck, small defective shoulders, "devil's grip," narrow back, pointed rump, flat thighs, slab-sided soft ribs, narrow brisket, thin bone, legginess, defective knees, hocks, pasterns, and fetlocks, or uneven quality of wool. Whatever faults the ram may have will show up in his progeny. The ram that is growing wool of an uneven quality—that is, fine on the fore part and running to hair on the hind quarters or with no crimp in it—if bred with will only cause trouble in the wool-clip, as the wool grown by the progeny will also be uneven in quality, and extra lines will be needed when classing it. Once started in a flock this means a lot of trouble and it may take years of careful culling to get the unevenness out of the clip. Such a ram can be termed a "brummy," and the best thing to do is to castrate him at once. With an even flock classing is easier, as the lines are larger and not so numerous, resulting in higher prices for the clip. Better prices will also be received for the rams or ewes when sold, as they are an even line and what the man just starting is looking for.—*The New Zealand Journal of Agriculture, Vol. XXV, No. 4.*

VI

Landowners and the State.

Lord Bledisloe, as President of the Agricultural Section of the British Association at Hull this year, struck a new note in his address. Put very briefly, his text was a demand for more leadership, and in particular for educated leadership by landowners in the business of farming. British farming has for the last two centuries in the main been carried on by tenants possessed of considerable capital, which is employed in the business and not in the land itself nor in its permanent equipment. The result, at any rate until fifty years ago, was successful. Complicated as the question of tenure was in detail, by custom it worked well on the whole ; a sufficiency of capital was attracted to the land to permit of cultivation on a comparatively large scale with sufficient continuity to encourage experiment and improvement, until British farm-

ing, whether as regards operations of cultivation, productivity of crops grown or quality of stock bred, stood easily foremost in the whole world.

British agriculture no longer enjoys the same undisputed position. We can still point with pride to its technical excellence, but it has not succeeded in so adapting itself to the changed economic conditions as to continue to be regarded as a prosperous industry or to attract the confidence of capitalists. Farmers, despite some protestations, can still make a living out of it, because they can always adjust their style of farming to any range of prices, but the position of the other two parties to the occupation of the land is far from satisfactory. Landowners' rents do not represent a reasonable rate of interest on the money that has been expended on the buildings, etc., necessary to the working of the farm. A piece of average English land in prairie condition could not to-day be equipped as a farm and then let at a rent which would pay market interest on the capital expended in equipping it, even though no charge were made for the land itself. Landowners who sold their farms during the last few years were able after reinvestment to double and treble the income they had derived from them, and at the same time to relieve themselves of many of the calls upon the landlord's purse. Agricultural labourers, again, though they effected some improvement in their position during the war, are still the worst paid industrial class of any magnitude in the community. In the villages it is well recognized that a boy is likely to be better off if he can get on the railway, into the police, or any of the other occupations more or less available, rather than go upon the land.

The tenant-farming system, for all its advantages, appears to be breaking down, and Lord Bledisloe regards the landowners of the last generation or two as in part responsible. From an abstract point of view the ordinary English tenant farm of 200 to 500 acres is no longer the economic unit it once was. At its inception it represented wholesale large scale production as compared with the generality of European farming, and, as such, it provided the food needed for the early industrial development of the country.

But with the enormous extension of wheat growing and meat production in the newer countries, the effect of which on our markets began to become so apparent from the seventies of last century onwards, and with modern organization of the trade in food products from countries with a low wage standard, the English farmer no longer controls prices, and when he stands alone, he is selling as a retailer in a market dominated by much larger interests. It has become a terribly difficult market, because Great Britain is now the one absolutely free emporium to which

the surplus food products from every other food-producing country in the world are directed. With one or two minor exceptions (Denmark and Belgium are practically free-trade countries, but they are normally food exporters rather than buyers), the British farmer is met by a tariff wall whenever he has a surplus to export or a speciality to develop, and these difficulties are, at the moment, accentuated by the break in the Continental exchanges, which diverts to Britain even the limited quantities of food-stuffs the foreign industrialist had begun to purchase.

Some of these difficulties may be overcome by co-operation, never an easy matter to organize in a conservative community such as our farmers form, bred as they have been in an individualist organization of business and imbued with the characteristic British tradition of standing alone. In any case, co-operation may be only a palliative: the economic flaw in the tenant-farming system probably is that the unit of management is too small. There is not work for a master in controlling the five to ten men employed on the ordinary English farm: as a managing head one man should be able to supervise the working of 1000 to 2000 acres, according to the class of land. Economic pressure would thus appear to be tending to move away from the present type of British farm in two directions, either towards the single-man holding, uneconomic as an instrument of production but in which compensation is found in the extra labour the occupier will give as exchange for his independence, or on the other hand, towards the really large farm which can take advantage of machinery and organization.

Lord Bledisloe's main contention is that the landowner must either take the latter option and become the instructed business head of his estate treated as a single farm, or if he prefers not to take over the actual management, he must at least be the leader and entrepreneur of the associated business of his tenants. Not only is the holding of land a bad investment, but in a modern State the mere rent receiver will eventually be eliminated. Landlords must give service or perish as such, and Lord Bledisloe appeals to a class which has a long and honourable tradition behind it of service to the State to return to the land and so render a necessary service to a State that is becoming overweighted on the industrial side. He points out the two directions in which the landowner can lead his tenant and benefit both his estate and the course of agriculture. In the first place, the farmer to-day is not getting his fair share of the prices the consumer pays for food. While all the producing interests connected with the land are unprosperous and are being forced to contract their activities, the trading organizations which deal in the produce of land are paying handsome dividends and individual middle-

men are growing rich. The consumer reviles the farmer because of the scarcity of food; the farmer knows he must restrict his production in order to make it pay at present prices, while the slightest production above the normal demand cuts away not merely profits but often cash returns, as may be seen over plums and potatoes at the moment. The distributing trade has entrenched itself in order to retain its war scale of margin, and the building famine in the country hinders the growth of competition. Lord Bledisloe gives a series of tables to show the discrepancy between retail and farmer's prices and the increase of that discrepancy since the war; in most cases the distributing trades take more than half the price the public pays. Coarse 'middlings' cost more than wheat, and readers of the *Times* a few days ago may have noticed that on the same day the price of London flour was put up while wheat was, in another column, reported as cheaper.

It is to this state of things that Lord Bledisloe recommends land-owners to turn their attention; can they not organize the business of their farmers into something capable of keeping the middlemen in check? They should be able to see further than the farmer, who has to look after his own business of production. Co-operation has made but little headway among farmers themselves; would it not be in a very different position if it had been whole-heartedly and intelligently backed by the land-owners? Here is one opening for intelligence and leadership on the part of owners of land.

The other great opening is in connexion with education and research. The old race of landlords numbered among them great improvers of farming, such as Weston, Townshend, Coke, and Lawes. Even the much-abused farming covenants represented, to begin with, better systems imposed upon their tenants by landlords. To-day, if English farming practice is in many respects still ahead of its competitors, it has become, comparatively speaking, not so alive to the applications of science. Farmers themselves are not quite what they were; the great industrial development of the last sixty years has been drawing away the brains from the more slowly moving pursuit of agriculture, and, speaking broadly, the present race of farmers are not educated up to their needs or their opportunities.

Here again the landowners have not been, but can be, leaders; they can become intelligence centres, they can stimulate the education of their tenants and of their tenants' sons, they can even insist on education in selecting their tenants. It is the lack of appreciation of science among landowners that has made it a plant of slow growth among their tenants.

The address is really a powerfully worded appeal from Lord Bledisloe to the land-owning class to treat land-owning as a vocation and to educate themselves for it. It is far-sighted call for service, and coming from one who has so notably put into practice what he preaches, carries with it an authority which no ordinary admonition to progress can possess.—*Nature, Vol.* 110, *No.* 2763.

VII.

Will the Human Race finally Starve?

By Eugene Davenport.

As I am about to retire from university work after thirty-four years of active service, Farm and Fireside has asked me to set down the outstanding impression resulting from this experience as applied to the field of agriculture.

Briefly put, the strongest impression on my mind to-day in respect to agriculture is that, nationally, we have struck a problem for which no solution as yet appears, and from which, unless solved before many generations go by, nothing but national decline seems possible.

Before elaborating this strongest impression the years have left on my sub-consciousness, it is necessary to remind the reader that a good proportion of what we know of the science of agriculture has been developed within the third of a century of which we are speaking. This is a very long time in a rapidly developing subject, and many things have happened that have passed quite out of mind as newer questions have arisen. For example, way back we were talking about the nitrogen mystery, about nitrogen producers and consumers, and noted botanists were advising that "warts" be bred off clover roots. About this time a letter from Sir John Lawes to that veteran agriculturist, Manley Miles, pointed out that within his life-time England had well-nigh exhausted the guano beds of the South Sea Islands that had been thousands of years in farming, that there must be some natural process of nitrogen fixation by wholesale, and that it must be soon discovered or the civilized world would decline from lack of food.

I saw this letter, and it made a deep impression on my mind, for at the time nobody knew that the discovery of nature's choicest secret was just at hand. Four years later I saw at Rothamsted the original clover plants which had been used in the solution of the mystery, and which fully confirmed the discovery of Helriegel. This meant that the nodules of clover are agents for fixation of atmospheric nitrogen. The great agricultural mystery was solved, and it all seemed very close to the foundation of things fundamental. This retrospect dates back to

the beginning of the experiment stations, and one of its outstanding features is the promptness with which farmers recognized and utilized the results of research. They ignored the agricultural colleges for thirty years, but they did not ignore the experiment station.

As books began to multiply, the art of farming gave way to the science of agriculture in farmer's meetings everywhere as matter for discussion, and while many were indifferent to the changed conditions, and farmed as their fathers had farmed, yet a surprising number, especially of the very young and the very old, adopted at once the newer methods indicated by experimentation. This interest of farmers in the results of investigation, and their support of agricultural colleges and experiment stations, has been a matter of constant wonder and perpetual satisfaction.

Prominent among the new ideas was the care of the land. Hitherto, interest had not gone much beyond the immediate crop; but with the further and deeper study of soils and of the results of farming, it became clearly evident that in general continued cropping tends to the destruction of the land.

As this question at first presented itself it took the following form: Is it possible so to operate the land that it shall yield profitable crops and at the same time increase instead of decrease its store of fertility; or must humanity exist at the expense of the natural supply of fertility, as it does of coal, for example? Are we as people simply going through a brief geologic period, only to become extinct like species that have gone before, as soon as we ourselves have destroyed the conditions of our own existence, by working out the stuff of which food is made? Or may we hope for perpetual productivity?

This question troubled some of us exceedingly, and the soil survey of Illinois, now nearing completion, was started in order to locate and invoice the state's stock of food-producing possibilities.

Along with the survey went exhaustive field experiments on all the principal types of lands, and with all possible combinations of fertilizing materials that could be had cheaply enough to give promise of being made permanent.

On all the better lands of the state it early became evident that, in the hands of capable farmers, the problem of a permanent agriculture was not inconsistent with profitable farming, and this showing was, of all new discoveries, the most satisfactory so far as the writer was concerned. It was equally evident that poor or badly worn soils could be brought up to a satisfactory yielding power only by an initial investment that required at least some capital, while the combination of poor

farmers and poor land seemed then, as it does still, an impossible combination, promising only bare existence for the farmer with nothing left over for the land.

We have always recognized a difference between good farmers and poor farmers, but we have mostly regarded the difference as expressed in yield of crops and its influence in determining how the farmer "got along," how he paid his debts, and how he fed, clothed, and schooled his family. We have not much considered the effect upon the land and its future occupants, but latterly this phase of the matter is giving deep concern to thoughtful men. It is the effect of mediocre men on the fertility of the land and its power to yield, and therefore upon national wealth and security, that has come to loom largest in the mind of the writer as an unsolved problem, not only in agriculture but in racial economics as well.

Specifically, this seems to be about the way the matter stands with the present state of knowledge.

The average man in any business, farming included, makes no money, because he is the centre of gravity about which prices tend to move. At certain periods, with favourable demand, this average man may get ahead a bit, but in general he pays out even: and the man below the average, being even worse conditioned, must take the difference out of his living, or out of his children, or out of the soil, and in many cases it comes out of all three.

There is no doubt about the fact that it is more difficult to organize and conduct a kind of farming that fully sustains the fertility of the soil than to proceed without regard to the land. It is more difficult because it requires a deeper knowledge of the principles involved, and also because it requires more money to be invested and handled all along the line. In brief, any kind of farming that preserves the land is more complicated than one that ignores the question of fertility.

All these elements add to the difficulties and tend to put high-grade farming out of the reach of the average man and below. Besides, it is next to impossible to make the average man believe that his soil needs attention. Of course it is as good as his neighbour's just over the fence. He will not believe that his yield is running down, for the process is gradual and he lays his poor crops to a bad season. It is impossible to get him to read the newer books and the better papers, for he does not realize how fast the world is moving.

Again, it is more difficult to conduct a business when the amounts of money going out and coming in are large than when they are small. The poor farmer attempting to do better farming is certain to borrow

the money to buy the fertilizer, and he is likely to take the increased yield as net income, and so swamp himself solely because of his enlarged operations.

Now, there will always be the average man and below, as an economic proposition. We may raise the average, but it will always be the average. Financially speaking, the average man will not be well-to-do, but scientifically he could, if he would take care of the land properly.

Of course, if he could so raise the average as to include the protection of the land in his scheme of things, the public would be safe even if the individuals did remain on the dead level of mediocrity. But it is extremely difficult to convince this average man that he should exercise his ingenuity, run into debt for fertilizer, conduct a more complicated and therefore dangerous business, unless he can be shown that he will profit by the extra labour and hazard. But if he does so profit, then he will no longer be an average man but will rise above it ; and if he does not, then he will revert to the easier and cheaper method, which is one of fertility mining and of soil depletion.

So there we have it. A few of the better farmers are so adding to the soil that they are maintaining its full stock of fertility, and will leave the land better than the average are mining the land as effectually to exhaustion as we are working out local mines and as we have destroyed our great forests.

The writer is just now boxing books. Boxes that he brought with him thirty years ago are of a grade that does not now exist. We are furnishing houses and making furniture now with worse lumber than that which went into packing boxes a generation ago. We used to make fences and pig pens of clear stiff pine, and now it no longer exists except as one of the rearer woods. Only the few can use it, and then only in special cases. Nationally speaking, we are doing to our fertility exactly what we did to our great pine forests, only the process is slower and less evident. It is none the less certain.

The hopelessness of the situation is the depressing part of it, as we consider this man below the average, in whose hands and under whose management so large a share of our national lands must rest.

Frankly, I have no solution for the problem, though a solution must be found. I would advocate a national subsidy for land improvement as for the merchant marine, were such a thing practicable or possible under present conditions. It would be infinitely better than going the way of the Pharoahs, but there is no use in talking a thing like that when we are well-nigh swamped by bumper crops that have difficulty in finding a paying market, and there is little use in asking the average

farmer to incur additional expense when we know that under normal conditions he will only get his money back and under present conditions he will not do that. And yet it gives one gooseflesh to consider what a large proportion of the national domain is being mined out for present profits. It is a losing proposition for all of us, generation by generation, but it looks as if we were going the way of the timber in spite of all that science has done and is doing for a better agriculture.

I am aware that this is a rather gloomy view, and that pessimists are not in favour now when all prophets are enjoined to "prophesy pleasant things unto us". But, nevertheless, certain facts must not be ignored in a critical programme, and this programme will not take care of itself.

We are very rapidly building up a great country, very largely at the expense of the virgin fertility of our lands. A few farmers here and there are applying fertilizers intelligently: but, considered as a national enterprise, the enormous crops which we are taking out of our land from year to year are so many subtractions from our native store of wealth, which is the free gift of nature.

Individuals are making money on land by its rise in value, but the land itself, which is the basis of the traffic, and which has provided a very large share of our national wealth, is getting very little in return. It is the innocent bystander, and is being exploited pretty effectually by all interests. It is not properly drained, it is not properly fed, nor are its betterments what they should be, considering that this generation of advanced farmers is mining out of its natural store more than any other generation has mined out before or will ever be able to mine out again. It is indeed a serious question whether under present conditions our knowledge of scientific agriculture is being used in a way that will strengthen our national life a hundred years from now, or whether all hands are using this information to enhance our present incomes, which are largely being spent on consumable goods rather than on permanent betterments.

When a company pays a million dollars or so for a hotel site in Chicago, and then proceeds to erect a five or six-million-dollar structure, it is possible to float the enterprise because it can catch in the passing a certain traffic that is reaping profits enough to enable it to enjoy the very best which the world is in the condition to produce. It pays the promoters; it is another question whether it pays the country.

The corollary of this proposition is the rather pessimistic impression that we are using the results of scientific invention and of increasing capital not to strengthen the country as a whole, but largely to substitute

idleness for labour and cater to our appetite for ease and luxury. In brief, are we not wasting a large share of our inheritance and opportunities ? This may be a very pessimistic impression, but I cannot fight off the feeling that we are not as a nation looking sufficiently far ahead.

Farming is not like a great capitalised industry which can float its stock as an investment and levy toll of the passing crowd almost upon its own terms. A man or a company sets out to manufacture and sell some thing which it believes the public will take at an estimated price. If successful, the management may, within reason, set its own prices and fix its own terms, so that the business will pay out by a kind of voluntary tax upon the enterprise of the country. Such is a great hotel, in a metropolitan city, catering to the fastidious who have the money wherewith to gratify their tastes. Such also is a popular luxury like a low priced automobile that sells itself like hot cakes at a country fair and without advertising.

If this kind of business fails by reason of a poor guess as to what the public will pay for, no great damage has been done beyond the loss to individuals ; indeed, it would sometimes be better for the country if failure should follow instead of success, as for example in the liquor business.

Such a concern must stand or fall upon its own legs. Not so in farming. A man may be ever so poor a farmer, yet he will not fail in the sense that business fails if only he keeps out of debt. He will live cheaply, raise a large family of children and work them to the limit, and take everything possible out of the land. If there were only here and there an individual of this sort there would be little involved beyond the social damage to the community.

But there are thousands of this class of people on the farms of the country. They are being gradually crowded on to the poorer lands, to be sure, but they are a damage to any soil because they take without giving.

And there are other thousands who operate the land rather successfully, draw upon the soils heavily, and spend the proceeds not in building up the land and the country but in selfish, often riotous, living, dissipating rather than amassing values.

In short, most failures on the farms are bad for the land. The soil is the silent partner in all farming, and for the most part it will get the short end of the evener. If this keeps up long enough, we shall ourselves "come out at the little end of the horn," along with the land.

For it is not enough that a few know how to farm scientifically and a few treat the soil as it deserves ; what is needed for safety's sake is

that practically everybody should treat the land as it deserves, recognizing that the soil has the first, not the last, lien upon all that is produced. If even ten per cent of our farmers tend to ruin the land, then to that extent is our national life diluted below what it ought to be and would be were our inheritance treated by everybody as a sacred trust.

The fact that the great mass of farmers insists upon taking for their own advantage everything that they can get out of the land makes it all the more difficult for good farmers to treat the land as it deserves, because the two compete together in the open markets of the world. This fact doubles the difficulty.

I see as yet no solution to the problem of general soil protection. There is of course no escape from the economic fact that the farmer below the average cannot make a profit on his business: but if we can find a way, by co-operative effort, mass production, or otherwise, to induce this average man to feed his land even though he as only comes out even in doing so, the country as a whole will be the better for it.

I see no present way in which it can be done and still leave the farmer as a free and independent enterpriser, and this for both social and economic reasons is a necessity to national welfare in a thousand ways.

The great effort should be to emphasize in season and out of season, the natural duty which everybody owes the land who undertakes to draw sustenance from it. Nobody expects to milk a cow without providing a feed. No more should he expect to milk the land and skim off the cream of fertility that has been thousands of years in accumulating, without some degree of restoration.

Some men are brutes, but few are brutal to a little child, and so far as we can convince the farmer that neglect of the land is brutal treatment of the rights of millions of unborn babies, so far can we exert some influence perhaps upon men otherwise oblivious to what they are doing. The example of Babylon and Egypt will help some, different arguments will reach others, and everything is good that will prick the consciences of men who live by the land.

This, it seems to me, is the "big idea" that stands out as the unsolved problem of agriculture. It is solved already as to the better class of farmers. It is not solved for the average and below, and these it is who constitute the so-called "drag of the race." How can they be reached and their damage to the land prevented? This is a great national question, and will be until it is satisfactorily answered.— *Farm and Fireside. Vol.* 46, *No.* 10.

The Mysore Agricultural and Experimental Union.

INSTRUCTIONS FOR CONDUCTING EXPERIMENTS.

Paddy Manurial Experiments with Oil-cake and Superphosphate.

Select 10 plots, each not less than a *gunta* in extent, on a field which has yielded a fairly uniform crop over the whole area as judged by previous experience. The area selected must be so situated that irrigation water does not flow from one plot to another. The whole area is to be moderately manured in the ordinary way according to local practice and plots 1, 4, 7 and 10 are to get no other manure. Plots 2, 5 and 8 are to be manured with oil-cake—ground-nut or castor, and plots 3, 6 and 9 with a mixture of cake and superphosphate.

Time of Application of Manure.

When paddy is transplanted, it is advisable to apply the manure a few days before transplanting soon after the last ploughing is done. When broad-casting is adopted, it is well to apply it after plants are thinned.

Rate of manuring per acre :—

1.	Ground-nut cake	.. 250 lbs.
	or	
	Castor cake	.. 500 lbs.
2.	Super-phosphate mixed with	
	Ground-nut cake	.. 125 lbs.
	or	
	Castor-cake	.. 250 lbs.

Arrangement of plots :—

1	2	3	4	5	6	7	8	9	10

or

1	2	3	4	5
6	7	8	9	10

or

1	2	3
6	5	4
7	8	9

[B. N. I.]

Sugarcane Borer—Trial of a New Remedy.

The remedy against sugarcane borer consists in attracting the moths which are the adults of the borer to small heaps of cane trash placed in the young cane field. The moths come from the old cane field and fly to the field at night and on break of day seek shelters amidst the grass on bunds on cane trash in the old cane field. If suitable shelters are provided in the newly planted field itself the moths will seek those in preference to those farther away. In the small heaps provided for them they are easily detected and being generally dazed by the light when exposed they are easily caught by the hand and killed.

The more the number of trash heaps in the cane field and the fewer the natural shelters usually available on bunds and elsewhere the greater the success of the remedy. The fields and bunds surrounding them should therefore be quite clear of weeds, rubbish, etc. The heaps should be placed at about twenty yards apart. In an acre plot there should at least be two alternating rows the outer one towards the edge about twenty yards from it and the other inside of the 1st about twenty yards from the latter. The plan suggested is indicated in the sketch.

*Trash heaps.

Each heap need not be more than can be pulled out by the hand and the heaps should be in the field before the canes have begun to sprout. Boys should be engaged to look for moths under the heaps and all found should be collected and crushed. The work should not begin before 8 o'clock in the morning but may be continued till late in the afternoon. The collection should go on for about two months without interruption. As boys go about the field they may come across moths of milk-white colour sitting conspicuously on the leaves of the young cane. These should also be picked and destroyed.

For about ten acres 2 or 3 boys alone are required. The number of moths collected may be small and some heaps may not have any moths at all but one female is capable of killing 3 to 4 hundred young shoots by means of their young, *i.e.*, borers. Besides it is these few of the first generation that give rise to a much more numerous later generation. All the cane under a tank or in one block should be taken up for the best results.

If the work has been thoroughly done, information may be kindly furnished on the following points, two months after planting :—

1. Date of commencement and end of harvest of cane.
2. Date or dates of planting of (3) and (4).
3. The area taken up for work.
4. The area under cane not taken up in the same block or near it.
5. The percentage of 'dead shoots' in (3) and (4).
6. The number of boys employed. The period of employment and the wages paid.
7. The number of moths collected.
8. Estimate of savings effected in the crop.

For more detailed information reference is invited to the Mysore Agricultural Calendar for 1923, a copy of which will be forwarded on application. [K. K. K.]

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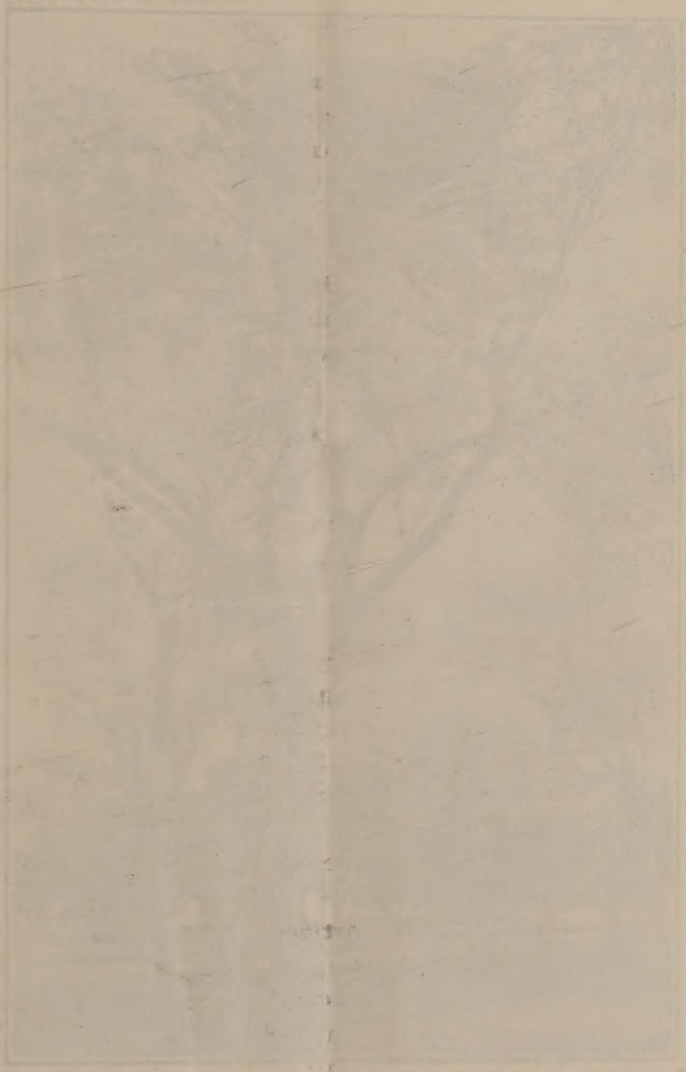

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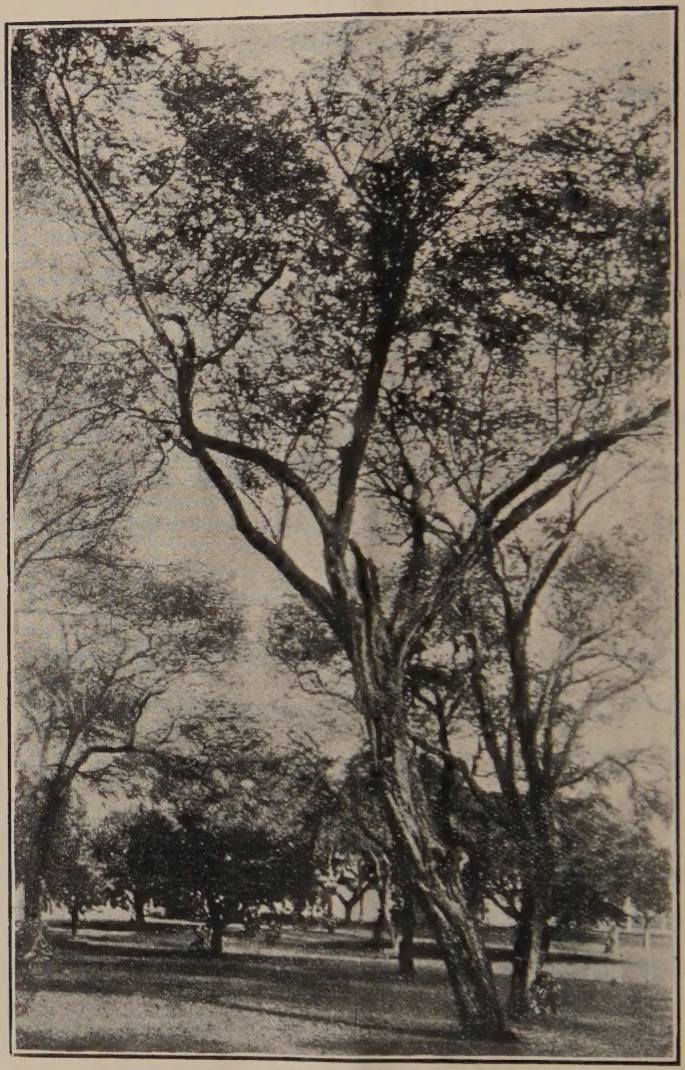

MESQUITE OR ALGAROBA *(vide page* 108*)*